GE Energy Services

D25 Multifunction IED

Installation & Maintenance Guide

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Table of Contents

Part III: Servicing the D25

About This Document

Overview

Introduction

This section of the *Installation & Maintenance Guide* is designed to introduce the user to preliminary information that should be reviewed before a user proceeds with installation, configuration or maintenance of a D25.

In this chapter

This chapter contains the following topics

Purpose of this Document

What this document provides

This *Installation & Maintenance Guide* contains information needed to install and configure the hardware of a D25 Multifunction IED.

The Product Overview section describes the various components of the D25.

The remainder of this Guide describes:

- installing and configuring hardware, software, and communications components
- using, maintaining, and troubleshooting the D25

The manual is formatted in a logical sequence that follows the recommended procedure for installing and configuring a GE Energy Services D25 Multifunction IED.

What this document does Not provide.

This manual does not provide any procedures for configuring the software of a D25.

For topics related to the use of GE Energy Services' Config Pro 4.x configuration utility, or details of any software application used in a specific D25, refer to documentation provided on the Config Pro CD-ROM.

Training Tool

In addition to the primary purpose of this User's Guide, its secondary purpose is that of a Training Manual for customer training sessions provided by GE Energy Services, or its agents.

Who is the Audience

Job Titles

This *Installation & Maintenance Guide* is intended to be used by SCADA system installers and field engineers who are responsible for the installation, hardware configuration and maintenance of a SCADA system containing D25 units.

Experience & Abilities

This *Installation & Maintenance Guide* assumes that anyone working with a D25 has some prior knowledge of:

- the electrical utility industry
- personal computer terminology
- GE Energy Services' products
- other industry products such as protective relays, meters, and voltage regulators

Support Services and Training

General

GE Energy Services provides professional assistance in the use of its software and hardware products.

Website

http://www.gepower.com/home/index.html

Unlimited access is available to a wide variety of information and company services — including product training and technical services.

Need Help?

If the D25 Multifunction IED does not operate normally when the operating instructions in this User's Guide are followed, contact GE Energy Services for assistance.

Problem resolution procedures not recommended by GE Energy Services might result in damage or injury to persons and property.

Technical Support

Representatives are available Monday through Friday, 8:00 a.m. to 5:00 p.m. Mountain Standard Time.

Before Calling

If you do require help from GE Energy Services, assemble as much information as possible to assist your service representative in the resolution of your problem.

Examples of such information include:

- Contact information - company name, address, phone number, email and fax
- Issue title – basic title of what the problem is perceived to be
- Hardware options installed in your D25
- The name of the Firmware employed (i.e., sabxxxx, salxxxx)
- Software applications, including the versions being used
- GE Energy Services document titles and revisions you are using
- Configuration file to be emailed in for analysis

Contacting Us

GE Energy Services
2728 Hopewell Place NE.
Calgary, Alberta Canada.
T1Y 7J7

Toll-Free: + 1.800.518.2303
Phone: + 1.403.214.4600
Fax: + 1.403.243.1815
email: GEH_Calgary.Support@ps.ge.com

Product Returns

A Return Merchandise Authorization (RMA) number must accompany all equipment being returned to GE Energy Services for repair, servicing, or for any other reason.

Please contact GE Energy Services, to obtain a Return Merchandise Authorization number and for complete instructions for return shipments, before attempting to return any products.

Note: GE Energy Services *will not* accept product returns unless accompanied by the Return Merchandise Authorization number.

Warranty

Terms and Conditions

GE Energy Services warrants each D25 product to be free of defects in material and workmanship under normal use and service for a period of 18 months from the date of shipment from the factory.

In the event of a failure covered by warranty, GE Energy Services will undertake to repair or replace the unit without charge, providing that the warrantor has determined that it is defective.

Warranty shall not apply to any unit which has been subject to:

- Misuse
- Negligence
- Accident
- Incorrect installation
- Use of this product in a manner not specified by GE Energy Services in this User's Guide.
- Alterations by anyone other than GE Energy Services, or an authorized representative.

GE Energy Services is not liable for special, indirect or consequential damages, or for loss of profit or expenses sustained as a result of a product malfunction, incorrect application or adjustment.

Note

The above terms are subject to change at any time, or as stipulated in contractual agreements.

Safety Precautions

Important

Follow all safety precautions and instructions in this manual:

- Only qualified personnel should work on the D25 Multifunction IED. Maintenance personnel should be familiar with the technology and the hazards associated with electrical equipment.
- Read and thoroughly understand this *Installation & Maintenance Guide* before using the D25 Multifunction IED. Save these instructions for later use and reference.
- All AC voltage and current terminals are protected from accidental contact by mechanical safety shields. The D25 has been designed so that field wiring does not have to be touched or disconnected when removing printed circuit boards (PCBs).
- Modules that hold potentially hazardous voltages are designed to be removed with a PCB puller (located inside of D25 front cover, on the edge of the Indicator Switch Card). **Always use the puller provided**.
- The CONTROLS switch (on the front panel of the D25) has a mechanical protector to prevent accidental operation of the switch. The switch can be locked in either position.
- All electronic components within the D25 are susceptible to damage from electrostatic discharge. Observe standard precautions for handling electronic components.

Hazardous Voltages can cause shock, burns or death.

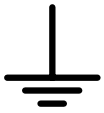
- Disconnect and lockout all power sources before servicing and removing components.
- Short all current transformer primaries before servicing.

Warning Symbols

Warning Symbols on Enclosure Back Panel

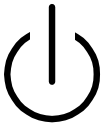
Caution (refer to accompanying documentation.)

Caution, risk of electric shock



Earth Ground Terminal

Protective Ground Terminal



Power Supply Off (Stand-by Mode)

Power Supply On

Patent Protection Label

On the rear panel of the D25 enclosure, a label similar to the one shown below will be printed.

This label is displayed as a formal notification of the US patents that protect the product and the technology developed by GE Energy Services

MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS:
5237511, 5303112, 5513061, 5701226

Part I: About Your D25

Overview & Contents

Introduction

The D25 is GE Energy Services' "Super IED" (Intelligent Electronic Device) providing unmatched integration of a wide range of substation measurement, status, control and communications functions.

In This Part

This Part contains the following Chapters and Sections:

Super IED

Integrated Functions

The D25 can function as a:

- programmable logic controller (PLC)
- substation LAN node
- IED gateway
- bay level controller
- power quality monitor
- fault/event (waveform) recorder

It is also unequalled as a standalone remote terminal unit (RTU).

Scalable Architecture

The flexible and scalable architecture of the D25 makes it an excellent option for:

- advanced substation monitoring
- control
- automation applications

It can accommodate a variety of discrete interface module options, such as:

- digital input
- AC or DC analog inputs
- digital outputs

Flexible Communication

- Communication flexibility optionally provides dual RS-232/485 serial communication ports or dual Ethernet LAN ports.
- Two standard RS-232/485 serial ports interface to legacy IEDs or Master stations.
- The extensive GE Energy Services library of application software is available to enable the D25 to interface with over 75 different IEDs.
- UTC port allows for global satellite time synchronization.
- Maintenance port support provides access to Config Pro, ProLogic, and WESMAINT utilities.

The D25 offers all these features and meets with the robust requirements of the IEEE, IEC and CE Mark

Plug-in Options

3 Components

The essential components of the D25 can be broken into three groups:

1. Hardware
2. Software
3. Communications.

The D25 Housing

The metal D25 housing contains the fundamental hardware, base software, and communication facilities to operate as a fully functional stand-alone control system.

Indicator LEDs on the front panel provide information about the operation and status of the D25.

The housing also has capacity to accept a variety of optional and expansion cards to increase the functionality of the D25.

The D25 provides a wide range of configurations for digital inputs, digital outputs, and AC and DC analog inputs in a compact package.

Multi Processor Design

The D25 utilizes an innovative multi-processor design to provide the large number of functions at best-in-class levels of performance.

This allows communications response performance to far exceed that provided by most other IEDs — even while concurrently executing:

- peer-to-peer and file transfer applications on the LAN
- waveform and event recording on up to 15 AC analog channels
- SOE monitoring on up to 96 digital input channels
- PLC algorithms
- data polls from IEDs
- metering and power quality functions in real time

Communication Options

The D25 architecture includes plug-in options for the substation LAN, serial, or other communications to a host system.

This allows the device to interface to the GE Energy Services iSCS Ethernet LAN with fiber optic, twisted-pair or coaxial options.

Most serial interfaces are user selectable from RS-232 or RS-485.

iSCS Ethernet LAN Node

Functioning as a LAN node, the D25 supports:

- peer-to-peer and client/server applications to other IEDs or nodes, such as the GE Energy Services D200 and the PowerLink graphical user interface
- file transfer of code and configuration files
- virtual or “loop through” connection support for internal functions and connected IEDs

Continued on next page

Plug-in Options, Continued

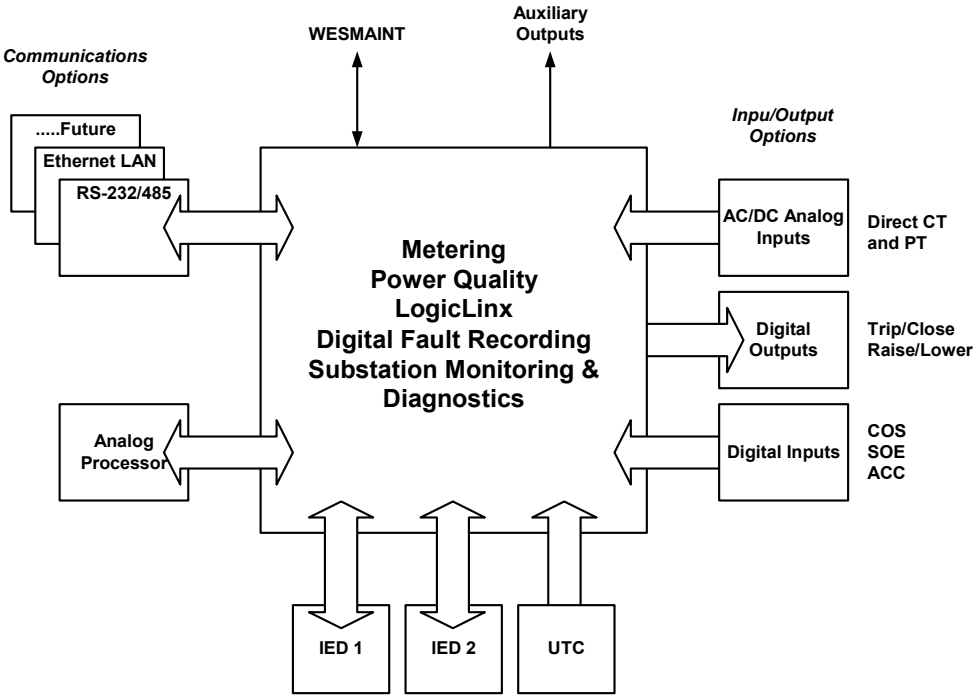
Serial Options

When equipped with the serial port interfaces, the D25 can function as a:

- standalone IED
- PLC
- RTU supporting the complete GE Energy Services library of over 60 host protocols including DNP 3.0 and MMS.

Integrated System

Virtually any of the available interfaces and options can be combined into a unique combination of capabilities, tailored specifically for your application.



Chapter 1: Technical Specifications

Overview & Contents

Introduction

This Chapter outlines the general electrical and physical specifications of the D25 product.

Once you have identified the generation of your D25, you can find a current, and more detailed list of:

- the many international standards that the product meets or exceeds, or
- more detailed electrical specifications and data accuracies,

by referring to one of the following GE Energy Services documents.

Recognizing D25 Generations

The following table will help you to recognize the generation of your D25 unit.

If Your D25 has these distinguishing characteristics…	it is this generation of D25…	then refer to this document
• V1.xx of the Plant I/O DCA (B049-0), or • a single DSP card, P/N 504-0008	Gen. 1	*PRPI-027.pdf*
• *V2.xx of the Plant I/O DCA (B049-0)	Gen. 2	*PRPI-035.pdf*
• V3.xx of the Plant I/O DCA (B049-0), or	Gen. 3	*PRPI-037.pdf*
• V4.xx of the Plant I/O DCA (B049-0) • 42x nominal CT inputs • a D25KE–4Z card	Gen. 4	*TBA*

* Note: V2.40 and above of the Plant I/O DCA (B049-0) will support the D25KE control card. In this case, refer to the Gen. 3 *PRPI-037.pdf* for the KE card specifications, and the Gen. 2 *PRPI-035.pdf* for the remainder of the D25's specifications.

In this chapter

This chapter contains the following topics

Electrical Specifications

Power Requirements	**Power Supply Input Options**	⎓ 20-60 V_{dc} (not avail. with GDP) ≂ 60-150 V_{dc}/85-135 V_{ac} 50/60 Hz ≂ 60-150 V_{dc}/85-135 V_{ac} 50/60 Hz (CE) ≂ 200-300 V_{dc} /198-264 V_{ac} 50/60 Hz ≂ 150-350 V_{dc} /187-265 V_{ac} 50/60 Hz (CE)
	Power Consumption	65 Watts (maximum)
Communication Ports	**Maintenance Port**	WESMAINT II+ DB-9-F, EIA 232 @ 9600 bps
	D25 Display Port	DB-9-F, EIA 485 @ 9600 bps
	UTC Time Port	DB-9-F, EIA 232/422
	Standard Serial Communication Ports (2)	DB-9-F, EIA 232/485 up to 38400 bps software configurable
	Optional XCOM Ports (2)	DB-9-F, EIA 232/485 up to 38400 bps software configurable, or Ethernet/802.3 10BASE2, 10BASE-T or 10BASE-FL
Digital Inputs	**General**	Up to 96 optically isolated digital inputs, organized in groups of 32 inputs
	"On" threshold options, per card	12, 24, 48, 120, 250 V_{dc} ±20%, bipolar inputs
	Burden	From 0.75 mA to 10 mA max. power dissipation is 0.5W per input
	Wetting Options	Internal - 24 or 48 V_{dc}, isolated only, External wetting - for all input options
Digital Outputs	**Module Options**	D25K modules - 8 or 16 digital outputs with single component failure protection and detection, preventing false control of any coil driver output; select-check-before execute security; master trip/close bus scheme. D25K-4Z modules – as above, plus the 8 output relays switch both sides of the load for additional security. i.e., all control voltage is removed from load when relays open. D25KE modules – same as D25K module, with 8, 16, 24, or 32 output relays D25KE–4Z module – with 2x8 or 2x16 output relays

Continued on next page

Electrical Specifications, Continued

Digital Outputs (continued)	**Output Relay Contacts**	D25K modules D25K-4Z modules D25KE modules	1 Form A 4 Form A 1 Form A
	Maximum Switching Power	60 W (resistive) or 125 VA (resistive)	
	Maximum Switching Voltage	D25K, D25KE DB-25, and D25K-4Z	75 V_{dc} or 50 V_{ac}
		D25KE FACE-40 and D25KE-4Z	120 V_{dc}
	Maximum Switching Current	D25K, D25KE and D25KE-4Z	2 A
		D25K-4Z module	1.0 A @ 50 V_{ac} / 0.8 A @ 75 V_{dc}
	Maximum Carrying Current	D25K and D25KE D25K-4Z module	2 A 3 A
	Interposing Relay Option (D25K and D25KE only)	Groups of eight digital outputs can be directly interfaced to D20 KI modules	
Auxiliary Digital Outputs	**General**	Three single digital outputs for System Fail indication, Radio Keying and Auxiliary Digital output	
	System Fail Relay Contacts	1 Form B	
	Other Aux. Output Relay Contacts	1 Form A	
	Maximum Switching Power	60 W (resistive)	
	Maximum Switching Voltage	75 V_{dc} or 50 V_{ac}	
	Maximum Switching Current	2 A	
	Maximum Carrying Current	2 A	
DC Analog Inputs	**General**	16 optically isolated differential inputs	
	Measurement Range	120% of nominal	
	Overload Voltage	±30 V_{dc} (NM) continuous ±200 V_{dc} (CM) continuous	
	Nominal Voltage Input Range	±5 V_{dc}	
	Voltage Input Impedance	More than 10 MΩ	
	Nominal Current Input Range Options	±1 mA, ±5 mA, ±10 mA, or ±20 mA	
	Current Input Burden	5k to 250Ω (1 to 20 mA)	

Continued on next page

Electrical Specifications, Continued

AC Analog Measurement	**General**	Direct AC analog inputs from CTs and PTs , One to six 3-phase circuits, 15 AC analog inputs organized in groups of three (3) inputs, transformer isolated
	Line Frequency	50/60 Hz, nominal ±5 Hz
AC Voltage Inputs	**Nominal PT input options**	63.5 V_{rms}, 69.3 V_{rms}, 110 V_{rms}, 120 V_{rms}, or 220 V_{rms},
	Measurement Range	0% to 250% of nominal
	Overload Voltage	250% of nominal continuous 350% of nominal for one (1) minute
	Burden	Less than 0.1 VA
AC Current Inputs (Standard)	**Nominal CT Input Options**	1 A_{rms} or 5 A_{rms}
	Measurement and DFR Range	2% to 1600% of nominal, asymmetrical
	Thermal Overload	4 times nominal current continuous 30 times nominal current 10 seconds 100 times nominal current 1 second Note: continuous over-current may affect the accuracy of the current values. Refer to the appropriate PRPI (listed on page 5) for the accuracy specifications under over-current conditions.
	Burden	Less than 0.1 VA @ nominal input current

Continued on next page

Electrical Specifications, Continued

AC Current Inputs (42x Nominal)	**Nominal CT Input Options**	1 A_{rms} or 5 A_{rms}
	DFR Range	42x nominal
	Measurement Range	2% to 1600% of nominal, asymmetrical
	Thermal Overload	4 times nominal current continuous 30 times nominal current 10 seconds 100 times nominal current 1 second Note: continuous over-current may affect the accuracy of the current values. Refer to the appropriate PRPI (listed on page 5) for the accuracy specifications under over-current conditions.
	Burden	Less than 0.1 VA @ nominal input current
LCD Display	**Operating temp.**	-20 – 70 degrees Celsius
	LCD Display size	2.75” x 7.4”
Graphic Display Panel	**Operating temp.**	0 – 50 degrees Celsius
	LCD Display Resolution	320 x 240 pixels 0.36 mm pitch
	Color	blue/black on white background
	Viewable area	4.76” x 3.58”

Physical Specifications

Size and Environment	**Dimensions**	Width	19" (48 cm)
		Height	8.75" (22 cm)
		Depth	9" (23 cm)
	Weight	33 lbs. (15 kg) maximum	
	Operational Temperature	-20° to +70°C 0° to +60°C with Alphanumeric Display (LCD) 0° to +50°C with Graphic Display Panel (GDP)	
	Storage Temperature	-40° to +90°C -20° to +70°C with Alphanumeric Display (LCD) 0° to +70°C with Graphic Display Panel (GDP)	
	Humidity Rating	0 to 95% relative humidity, non-condensing	
	Environmental Rating	IP20	
	Installation / Overvoltage Category	Class II	
	Pollution Degree	2	
Field Terminations	**Digital Outputs**	Male DB-25 connectors for interconnect to an interposing relay panel or, 300 V_{dc} rated compression terminal blocks suitable for 22 – 14 AWG (0.2 – 2.0 mm^2) wire	
	Power Supply Inputs	250 V_{ac} rated barrier blocks, using 6-32 screws, suitable for 22 – 14 AWG (0.2 – 2.0 mm^2) wire	
	AC Analog Inputs	600 V_{ac} rated barrier blocks, using 6-32 screws, suitable for 22 – 12 AWG (0.2 – 2.5 mm^2) wire	
	Digital Inputs, Auxiliary Digital Outputs and DC Analog Inputs:	300 V_{dc} rated compression terminal blocks suitable for 22 – 14 AWG (0.2 – 2.0 mm^2) wire	
	Ground Stud	6-32 x 7/16 in. (10 mm) Note: Ground wire must be the largest gauge of all wires used for field termination. A green and yellow 12 AWG (2.5 mm^2) wire is recommended.	

Chapter 2: Before Installation

Overview & Contents

Introduction

This Chapter of the manual will help a user visually check a D25 for:

- possible shipping damage
- installed features and components

This section will also help the new user become familiar with the location of the many connectors, indicators and switches externally accessible on the D25.

Lastly, this section provides information about the storage of a D25.

In This Chapter

This Chapter contains the following topics

Inspection

Unpacking

Inspect package before opening to see if it has sustained any damage from impact or water. If it has, report it immediately without opening it. Carriers may not assume responsibility for damage after the customer accepts delivery.

Carefully remove the D25 from its packaging. Visually inspect the unit to ensure it has not sustained any visible damage during transit.

The figure below shows a D25 IED with the Graphic Display Panel option after it has been removed from the box.

Product Identification

Before installing the unit, check the part number on the back of the unit is in agreement with the shipping and ordering documents.

This same number is used in the Config Pro configuration tool to set the *Properties* of the D25 device, ensuring that the configuration matches the actual hardware.

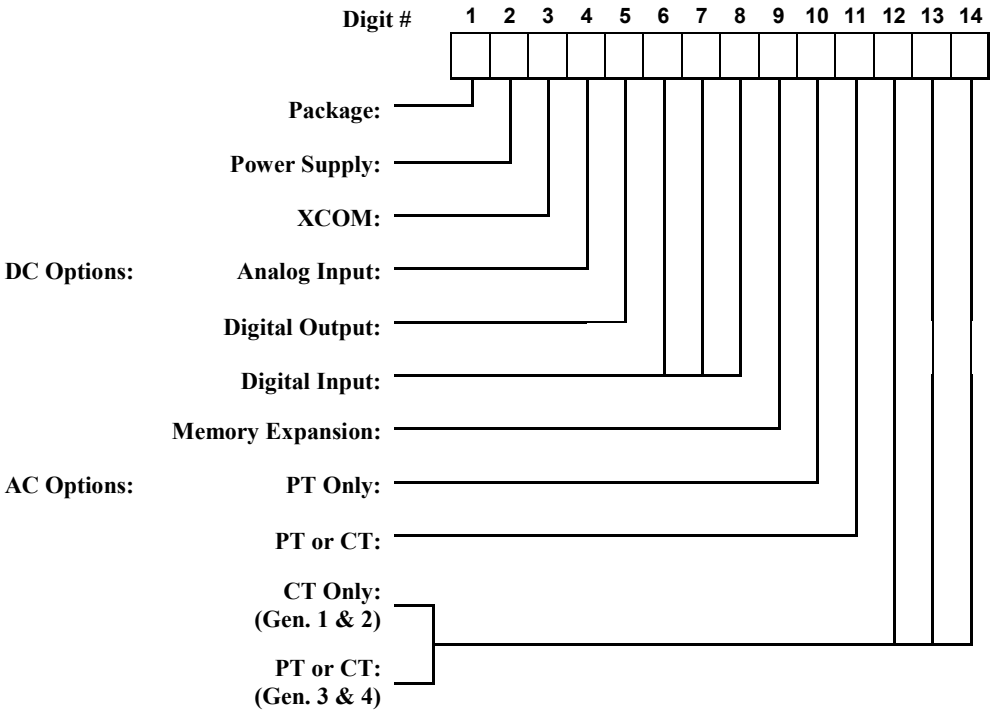
The diagram on the following page will help to identify the options present in your D25.

Continued on next page

Inspection, Continued

Part Number

This chart represents the significance of each digit of the part number shown on the label on the rear of the D25 enclosure.



Notes

- The part number label on the rear of the enclosure will correctly identify the D25 options at the time of delivery.
- If the D25 has had option changes since delivery, the part number label may no longer represent the product options accurately.
- It is advised that users update their part number label to match any option changes made in the field.

D25 Component Options

Overview

The tables on the following pages are provided to help the reader:

- Identify their D25's components and their part numbers, based on the *Device Code* tag fixed to the rear of the enclosure.
- Be aware of the parts that can be ordered as spares inventory or replacements.

Notes: Be sure to consult your GE Energy Services representative, or the *WEB Store* to confirm part numbers and availability before ordering.

Part Numbers are subject to change without notice.

D25 Package Options:

All eight options have the same basic 19 inch, 5U rack mount enclosure, and include:

Ident.	Description
1	WESDAC Card with 1 M FLASH memory
2	WESDAC Card with 2 M FLASH memory
3	WESDAC Card with 2 M FLASH memory, LCD text display
4	WESDAC Card with 1 M FLASH memory, LCD text display
5	WESDAC Card with 2 M FLASH memory, no display, CE compliant
6	WESDAC Card with 2 M FLASH memory, LCD text display, CE compliant
7	WESDAC Card with 2 M FLASH memory, no display, and front panel assembly with English and Chinese characters.
8	WESDAC Card with 2 M FLASH memory, Graphic Display Panel– GDP

Note

As of the date of this document, the Type II WESDAC card 1 M Memory option is no longer being provided. 2 M boards are now standard.

Power Supply Options:

Seven options:

Note: Units marked (*) are required for CE Mark certification.

Ident.	Description		Part #
1	LVPS: 60 – 150 V_{dc} / 85 - 135 V_{ac}	24 V Field O/P	521-0124
2	HVPS: 200 – 300 V_{dc} / 198 - 264 V_{ac}	24 V Field O/P	521-0118
3	20 - 60 V_{dc}	48 V Field O/P	521-0119
1	* LVPS: 60 – 150 V_{dc} / 85 – 135 V_{ac}	24 V Field O/P	521-0135
2	* HVPS: 150 – 350 V_{dc} / 187 - 265 V_{ac}	24 V Field O/P	521-0136
4	* LVPS: 60 – 150 V_{dc} / 85 – 135 V_{ac}	48 V Field O/P	521-0139
5	* HVPS: 150 – 350 V_{dc} / 187 - 265 V_{ac}	48 V Field O/P	521-0138

Continued on next page

D25 Component Options, Continued

XCOM Options: Six options:

Ident.	Description	Part #
0	Not Installed	
1	10BASE2 Thin Coax / BNC	580-0932
2	Serial RS-232/485 (Special Order)	580-0933
3	10BASE-FL Fiber-optic / ST	580-0993
4	10BASE-T Unshielded Twisted-pair (UTP)	580-0994
5	Serial RS-232/485 Standard	580-0991

DC Analog I/P Options: Thirteen options:

Ident.	Description	Part #
0	Option Not Installed	
1	DC Analog I/P 8 Chan. +/- 5V	517-0397
2	DC Analog I/P 16 Chan. +/- 5V	517-0413
3	DC Analog I/P 8 Chan. +/- 1 mA	517-0404
4	DC Analog I/P 16 Chan. +/- 1 mA	517-0408
5	DC Analog I/P 8 Chan. +/- 5 mA	517-0405
6	DC Analog I/P 16 Chan. +/- 5 mA	517-0409
7	DC Analog I/P 8 Chan. +/- 10 mA	517-0406
8	DC Analog I/P 16 Chan. +/- 10 mA	517-0410
9	DC Analog I/P 8 Chan. +/- 20 mA	517-0407
A	DC Analog I/P 16 Chan. +/- 20 mA	517-0411
B	DC Analog I/P 8 Chan. Scalable Adapter	517-0416
C	DC Analog I/P 16 Chan. Scalable Adapter	517-0417

Scaling Adapters Scaling Adapters for options B or C above:

Note: Adapters are *not* identified in the D25 part number.

Description	Part #
+/- 5 V	530-0004
+/- 1 mA	530-0050
+/- 5 mA	530-0005
+/- 10 mA	530-0045
+/- 20 mA	530-0052

Continued on next page

D25 Component Options, Continued

Digital O/P Options:

Twenty options:

Ident.	Description	Part #
0	Option Not Installed	
1	Digital Output (8 T/C or 4 R/L) DB-25	517-0396
2	Digital Output (16 T/C or 8 R/L) DB-25	517-0395
3	Digital Output (8 T/C or 4 R/L) FACE-40	517-0414
4	Digital Output (16 T/C or 8 R/L) FACE-40	517-0412
5	Digital Output K–4Z (8 T/C or 4 R/L) FACE-40	517-0440
6	No Control Card, ready for K-card FACE-40	
7	No Control Card, ready for K-4Z-card	
8	Digital Output KE (24 T/C or 12 R/L) FACE-40	517-0450
9	Digital Output KE (32 T/C or 16 R/L) FACE-40	517-0443
A	Digital Output KE (24 T/C or 12 R/L) DB-25	517-0453
B	Digital Output KE (32 T/C or 16 R/L) DB-25	517-0447
C	No Control Card, ready for KE-card DB-25	
D	No Control Card, ready for KE-card FACE-40	
E	Digital Output KE (16 T/C or 8 R/L) FACE-40	517-0452
F	Digital Output KE (8 T/C or 4 R/L) FACE-40	517-0451
G	Digital Output KE (16 T/C or 8 R/L) DB-25	517-0449
H	Digital Output KE (8 T/C or 4 R/L) DB-25	517-0448
I	Digital Output KE-4Z (16 Paired O/Ps) FACE-40	517-0455
J	Digital Output KE–4Z (8 Paired O/Ps) FACE-40	517-0454

Interposing Relay Options

Four options:

Note: KI boards are *not* identified in the D25 part number.

Description	Part #
WESTERM D20 KI 1	517-0166
WESTERM D20 KI 2	517-0167
WESTERM D25 KI-STD	517-0462
WESTERM D25 KI-ML	517-0463

Continued on next page

D25 Component Options, Continued

Digital I/P Options:

Twelve options:

Ident.	Description	Part #
0	Option Not Installed	
Low Voltage Boards		
1	32 Chan. Digital Input Card, Wetting Option 5 mA / 12V	517-0427
2	32 Chan. Digital Input Card, Wetting Option 24V / 5 mA	517-0402
3	32 Chan. Digital Input Card, Wetting Option 48V / 5 mA	517-0403
6	32 Chan. Digital Input Card, Wetting Option 10 mA / 24V	517-0425
7	16 Chan. Digital Input Card, Wetting Option 12V / 5 mA	517-0433
8	16 Chan. Digital Input Card, Wetting Option 24V / 5 mA	517-0432
9	16 Chan. Digital Input Card, Wetting Option 48V / 5 mA	517-0431
High Voltage Boards		
4	32 Chan. Digital Input Card, Wetting Option 0.75 mA / 120V (special order)	517-0426
5	32 Chan. Digital Input Card, Wetting Option 0.75 mA / 250V (special order)	517-0428
A	16 Chan. Digital Input Card, Wetting Option 0.75 mA / 120V (special order)	517-0434
B	16 Chan. Digital Input Card, Wetting Option 0.75 mA / 250V (special order)	517-0435

Memory Expansion:

Three options:

Ident.	Description	Part #
0	Option Not Installed	
1	MEMX 2 MB Card	504-0006
2	MEMX 4 MB Card	504-0007

Continued on next page

D25 Component Options, Continued

AC Input Options

If any of the AC input options are included in the D25, one of these modules are required:

Description	Part #
Gen. 1 Digital Signal Processor card (DSP)	504-0008
Gen. 2, 3 & 4 Dual Digital Signal Processor card (DDSP)	504-0009

PT Options

Six PT transformer options:

Ident.	Description	Part #
U	Option Not Installed	
C	120 Volt PT	450-0084
D	110 Volt PT	450-0086
E	69.3 Volt PT	450-0085
F	63.5 Volt PT	450-0083
G	220 Volt PT	450-0090

CT Options

Six CT transformer options:

Ident.	Description	Part #
U	Option Not Installed	
A	5 Amp CT, Short Leads 5 Amp CT, Long Leads	450-0087 450-0088
B	1 Amp CT	450-0105
H	5 Amp CT, (as per *A* above) Using High Accuracy CT Module (special order)	517-0429
I	1 Amp CT, 42 X overcurrent	450-0107
J	5 Amp CT, 42 X overcurrent	450-0108

AC Input Options:

Five subassembly options:

Note: These subassemblies are *Not* identified in the D25 part number.

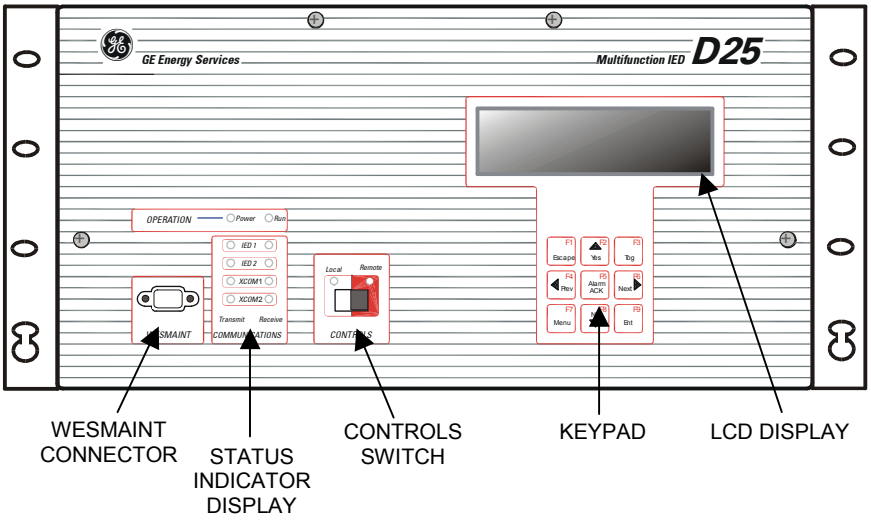
Description	Part #
D25 PT Module, used with any PT	517-0401
D25 CT Module, 300Ω burden, used with standard 5 Amp CT	517-0400
D25 CT Module, 400Ω burden, used with 450-0105 1 Amp CT only	517-0441
D25 High Accuracy CT Module (special order), 5Amp only	517-0429
D25 42 X Overcurrent CT Module, used with 1 Amp and 5 Amp 42 X CT	517-0456

Familiarization

Front Panel

The front panel presents these user interface components:

- WESMAINT II+ connector for attaching the D25 to a maintenance terminal or PC.
- LEDs for visual cues about status and operation of the D25 and traffic on communication ports.
- Local/Remote (CONTROLS) switch for setting local or remote operational state of the digital output module.
- Optional LCD Display allows a user to display selected data that is stored in the D25 database.
- Keypad is used to navigate around the menus shown on the LCD display.
  - Keypad is only present if LCD option is included.



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Familiarization, Continued

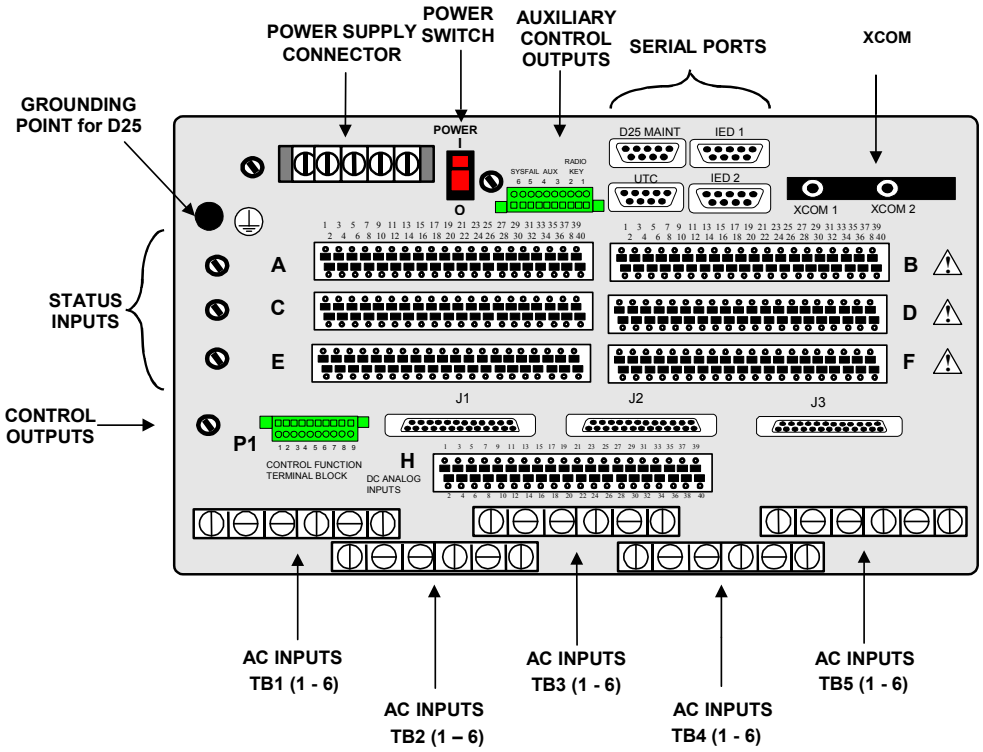
Back Panel

On earlier versions of the D25 enclosure, the connectors were permanently installed into the rear panel of the D25 for communications, power supply, digital inputs, digital outputs, and AC inputs. Later units use a more modular approach, with the back panel being made up of removable sections.

The types and number of connectors and associated back panels are specified when the unit is ordered, but can be changed in the field if required.

D25 Backplane Diagram – D25K DB-25 Control Connections

The diagram below shows a typical back panel using 3 S-boards and a D25K-board terminated with DB-25 connectors.



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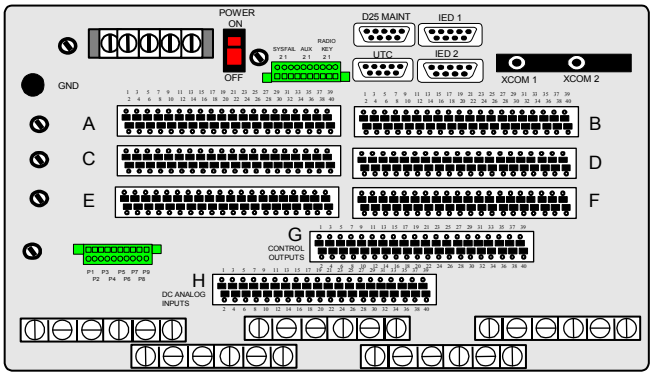
Familiarization, Continued

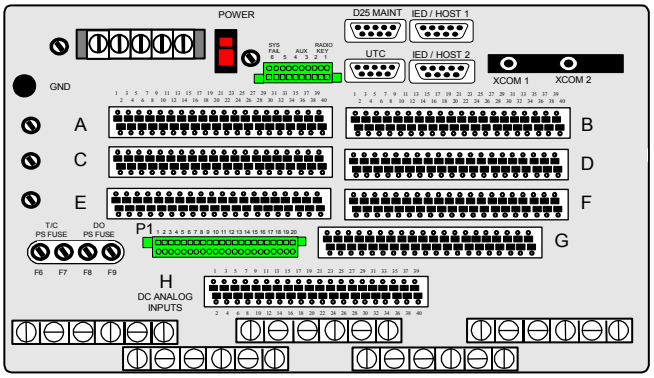
D25 Backplane Diagram – D25K FACE-40 Control Connections

The diagram below shows a back panel using the same boards as the previous diagram, but using a D25K-board terminated with a FACE-40 connector.



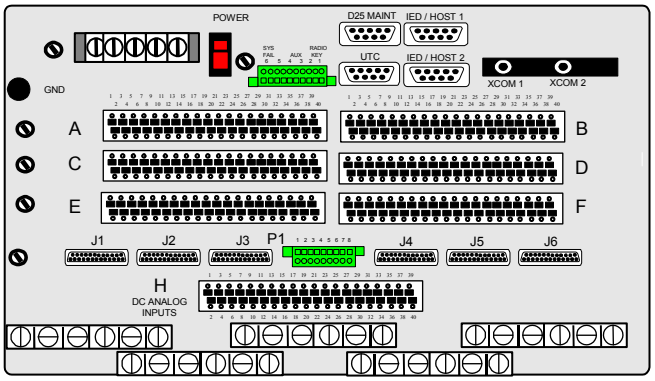
D25 Backplane Diagram – D25K-4Z FACE-40 Control Connections

This diagram shows a back panel using a D25K-4Z-board terminated with its only termination option, a FACE-40 connector.



D25 Backplane Diagram – D25KE DB-25 Control Connections

This diagram shows a back panel using a D25KE control board terminated with six DB-25 connectors.



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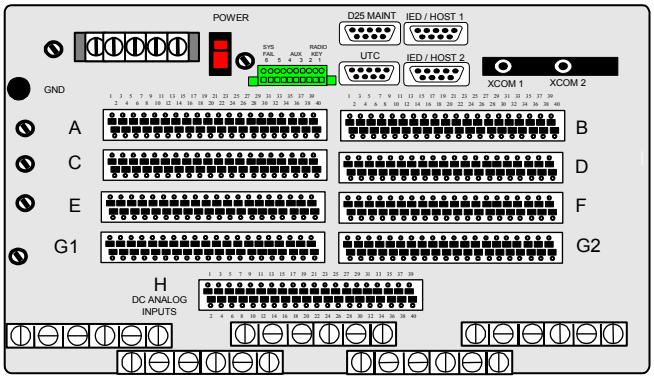
Familiarization, Continued

D25 Backplane Diagram – D25KE FACE-40 Control Connections

This diagram shows a back panel using a D25KE control board terminated with two FACE-40 connectors.



Storage

Environment

- Due to the locations in which the D25 might be installed, GE Energy Services designed the D25 to tolerate extreme environmental conditions.
- Specifications for storage are:
  - Temperature: -40° to +90°C
    -20° to +70°C with Alphanumeric Display (LCD)
    0° to +70°C with Graphic Display Panel (GDP)
  - Relative humidity: 0 to 95%, non-condensing
- As a general rule, always store the D25 IED in an environment compatible with operating conditions.
  - Refer to Chapter 1: *Technical Specifications* for more detailed environmental specifications.
- Exposure to excessive temperature or other extreme environmental conditions might cause damage and/or unreliable operation.

Battery Life

The battery mounted on the D25 Main (DAC) Board will maintain the contents of the NVRAM for over 5 years, with system power applied.

If the D25 is to be stored for extended periods, you may wish to disconnect the battery.

Chapter 3: Hardware Overview

Overview & Contents

Introduction

This Chapter provides a look at all of the various modules, both standard and optional.

The focus is on providing the reader an understanding of the features and functions of all of the D25 components and options, and how the components work together.

In This Chapter

This chapter contains the following Sections and Topics:

Section 1: Standard Components

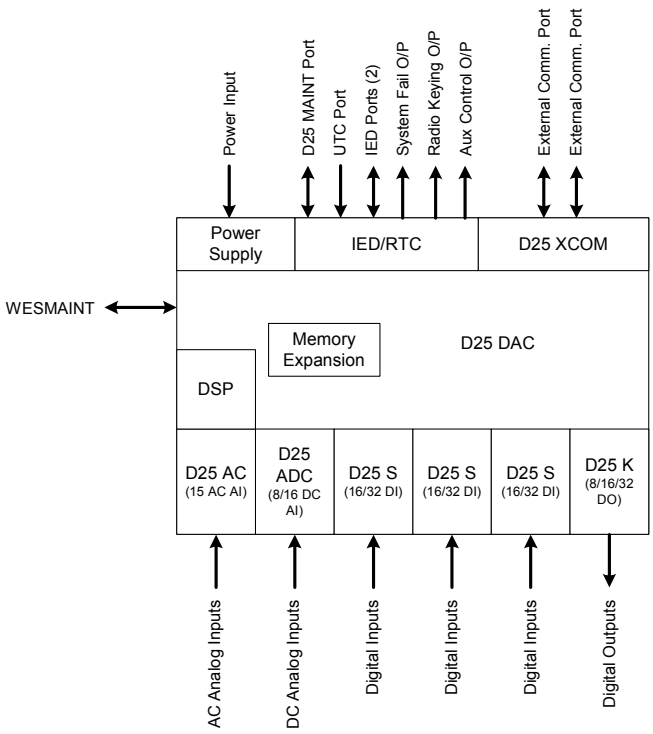
General Architecture

D25 Enclosure

The D25 metal housing contains the fundamental hardware and is loaded with the basic software to operate the D25 as a fully functional stand-alone control system.

The housing also has capacity to accept a variety of optional and expansion cards to increase the functionality of the D25. (Refer to *Upgrading a D25* in this *Installation & Maintenance Guide.*

Block Diagram



Block Diagram Overview

- The D25 DAC, or Main Board, is the primary intelligent functional block of the D25 IED, and contains all processing, storage, and control capabilities of the system.
- The IED/RTC card provides the standard communications interfaces, and auxiliary control outputs.
- The Memory Expansion card provides optional extra memory used for storage of files created by some of the optional software applications.
- The D25 XCOM provides an optional communications and interface to link a particular host or network.
- Physical I/O of the D25 is achieved through combinations of the D25 S, K, AC, and DC analog cards.
- The DSP card is used as an interface for the AC analog input modules

D25 DAC Module (Main Board)

Type II DAC

These two part numbers identify the Type II DAC boards with these FLASH memory options:

- 1 M (504-0005)
- 2 M (504-0005 vintage 7A and higher) and
- 2 M (504-0010).

All of the other modules that make up a D25 system will interface with the D25 DAC (Main) Board.

The external connections to the D25 are all isolated from the DAC by the various I/O and communication cards.

Type III DAC

The functionally identical Type III DAC board retains all of the operational characteristics of the previous board types.

Some jumpers have been removed from production units, and are identified in the table on page 163, *Type III Jumper Functions*

Main I/O Functions and Interfaces

- WESMAINT port
- D25 MAINT Display port
- Two independent IED communications ports
- Universal time code (UTC) input
- System fail digital output
- Radio keying digital output
- General purpose auxiliary digital output
- XCOM external communications module interface
- DSP module interface
- Memory expansion module interface
- Up to three separate digital input cards
- Digital output card
- AC analog input card
- DC analog input card

Design Features

The D25 DAC module supports the functionality of all D25 configurations with the XCOM and D25 S, K, AC, DC and DSP interfaces.

Battery Backup

A **Panasonic $BR^2/_3A$**, or equivalent, battery will maintain the contents of the NVRAM for over 5 years, if system power is applied.

Indicator Switch Card

General

The D25 Indicator Switch Card is used as an interface to the D25 DAC board.

The front side of the D25 Indicator Switch Card provides a DB-9 connector for WESMAINT access, display LEDs, and a Local/Remote switch.

The backside of the card provides a connector for a ribbon cable to the D25 DAC Board.

The 540-0412 variant has a connector for the optional Data Display Panel

LED Indications

The LEDs on the front of the D25 are discussed in more detail on page 29, *LED Indications.*

Leaving the Indicator Switch Card disconnected from the DAC board while the D25 is running will not damage the D25.

It will, however, behave as though the Local/Remote switch is in the **Local** position.

Power Supply

General

For specifications refer to the *Technical Specifications* Chapter in this Guide

Design Features

All seven available power supply options have these characteristics:

- The input supply includes reverse polarity protection.
- When the power switch is toggled down, into the off position, all power is removed from all modules — including any internally supplied relay coil power

Power Output Specifications

The table below shows the available power supply option input requirements, and their field voltage outputs.

Note: All power supply field outputs are regulated to ±10%.

Power Supply Type	Part #	Field Output
LVPS: 60 – 150 Vdc / 85 - 135 Vac	521-0124	24 Vdc
HVPS: 200 – 300 Vdc / 198 – 264 Vac	521-0118	24 Vdc
20 - 60 Vdc	521-0119	48 Vdc
LVPS: 60 – 150 Vdc / 85 - 135 Vac	521-0135	*24 Vdc
HVPS: 150 – 350 Vdc / 187 – 265 Vac	521-0136	*24 Vdc
HVPS: 150 – 350 Vdc / 187 – 265 Vac	521-0138	*48 Vdc
LVPS: 60 – 150 Vdc / 85 - 135 Vac	521-0139	*48 Vdc

Note

Power Supplies identified by an asterisk (*) above can be field-switched between 24 and 48 $V_{dc.}$ Refer to procedure on page 174.

Power Switch Location

The D25 Power Switch is located at the rear of the enclosure, just to the right (looking from the rear of the enclosure) of the Power Connection terminal block.

The Power Switch *does not* remove hazardous voltages from *all* of the power supply's circuitry when switched off.

Use care if operating the D25 with the top panel removed.

IED/RTC Card

General

This module has external five interface connectors located at the top-center of the rear of the enclosure:

- 2 - IED ports
- UTC Port
- D25 MAINT Display Port
- Terminal block with digital outputs of:
  - System failure (Sysfail) output
  - Radio Keying output
  - Auxiliary digital output

IED Ports

The IED/RTC module supports two independent serial RS-232 or RS-485 communications channels.

The interface options are selected by Config Pro during configuration:

- RS-232 or RS-485 selection
- 2-Wire or 4-Wire

Note: The 2 to 4-Wire selection in Config Pro's Device Properties *Does Not* change the physical characteristics of the communication ports.

Design Features

- The RS-232 option supports TxD, RxD, CTS, RTS, and DCD signals, and associated grounds.
- Supports data rates of 150, 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400 bps.
- Flow control is required for data rates higher than 9600 bps.
- Each channel can be programmed to support byte-oriented protocols

Indicators

LEDs on the front panel of the D25 illuminate to indicate when the IED ports are active, and whether signals are being transmitted or received.

UTC Port

The D25 has one Clock Interface protocol port known as the Universal Time Code (UTC) input.

The interface is configuration selectable for RS-232 or RS-422.

UTC Protocols

Present implementation supports only:

- Unmodulated IRIG-B interface
- Rugby clock
- Up to 9600 bps, as determined by application, (IRIG-B is typically 100 bps)

Note: Other IRIG-B interface options, such as coaxial or modulated signals must be accommodated through the use of an external converter.

Continued on next page

IED/RTC Card, Continued

D25 MAINT Display Port

This port provides:

- fixed communication parameters
- RS-485 2-wire/4-wire support
- transmitter time-out
- inter-character time-out

Design Features

- RS-485 serial interface allows for remote mounting of displays at 9600 bps
- Interface supports a locally mounted 16 alphanumeric character LCD display, and an 8-key keypad interface
- All power and signaling required for operation are supplied from the DB-25 DAC D25 Display interface
- Values are displayed in engineering units
- The display can be mounted to the front panel of the D25 housing, with all interconnect wiring hidden.

Units that are ordered with the front panel display and keypad *cannot* use the rear panel DB-9 RS-485 interface for additional displays.

Terminating the rear panel D25 MAINT connection will likely cause front panel display to not operate correctly.

Control Signal Digital Outputs

There are three digital outputs available through the Auxiliary Controls connector:

- System fail output
- Radio keying output
- Auxiliary control output

The contacts of the relays provide electrical and mechanical isolation for all three signals.

System Fail Output

System Fail Output provides:

- Form B (N/C) contact output with a rating of 60 W
- Maximum current: 2 A
- Maximum voltage across the output: 75 $V_{dc,}$ or 50 V_{ac}
- Contact wetting must be supplied from a source external to the D25

This output will be activated during the **P**ower **O**n **S**elf **T**est (POST) that runs whenever the D25 is reset via software or through cycling of power.

Continued on next page

IED/RTC Card, Continued

Radio Keying Output

Radio Keying Output provides:

- Form A (N/O) contact output with a 60 W rating
- Maximum current through the contacts: 2 A
- Maximum voltage across the output: 75 $V_{dc,}$ or 50 V_{ac}
- Contact wetting must be supplied from a source external to the D25

Radio Keying Output emulates "push-to-talk" whenever the D25 is configured to use radio communications equipment that requires this feature.

Radio Keying Operation

If enabled by configuring jumper JP1 on the IED/UTC card, the Radio Keying Output activates whenever the RTS line of XCOM1 is asserted.

Refer to: the procedure on Page 173, *Configuring Radio Keying Option* for details.

Auxiliary Digital Output

Auxiliary Digital Output can be used for control functions when use of a standard digital output is not practical.

The digital output under software control provides:

- Form A (N/O) contact output with a rating: 60 W
- Maximum current through the contacts: 2 A
- Maximum voltage across the output: 75 $V_{dc,}$ or 50 V_{ac}
- Contact wetting must be supplied from a source external to the D25

Note

When operating the Auxiliary Digital Output using WESMAINT, *Only* On or Off (latch) commands are supported.

Attempting any other mode of operation will result in an error code being displayed.

Section 2: Optional Components

Memory Expansion Board

General

A Memory Expansion board is a general-purpose card that provides extra data file storage space for use by applications such as the Oscillography Waveform Capture and Power Quality functions of the D25.

The two options provide either 2 or 4 Mb of additional RAM.

The D25 Memory Expansion module is an optional removable daughter card of the D25 DAC module, and is mounted at on top of the DAC Board, near the left edge of the enclosure.

Typically, this module is not required if the Power Quality (PQ) or Digital Fault Recording (DFR) options are not installed.

Digital Fault Recording

The D25 optionally can capture current and voltage waveforms on all 15 AC analog input channels at 64 samples per cycle.

Sampled values of current and voltage are stored for 240 cycles.

Oscillography waveform captures are triggered either by a digital input change, an analog alarm, or pseudo digital output.

For more information, refer to GE Energy Services document:

- *Power Quality Overview – Part # SWM0009/xx*

DSP/DDSP Cards

General

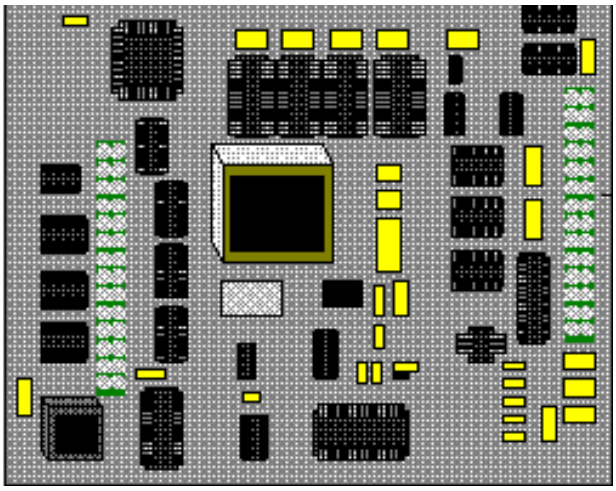
The DSP and DDSP (Dual DSP) modules (sometimes referred to as DSP1 and DSP2 respectively) contain the analog-to-digital conversion and digital signal processing (DSP) circuitry required for processing analog signals from the AC analog input cards.

The DSP processors also execute the program instructions for the Power Quality and DFR functions.

Note: This module is not required if the D25 is not equipped with the AC Analog input options.

Component Location

Both of the DSP and DDSP boards are mounted on top of the D25 DAC (Main) Board just left of center of the enclosure.



Note: The DSP card (shown above) is mounted with component side facing out, while the DDSP card is mounted with component side facing toward the DAC main board.

D25S Digital Input Cards

General

Digital inputs have bipolar inputs that can interface to grounded or ungrounded systems.

All inputs are optically coupled to isolate the inputs from the logic section of the D25.

Input Options:

Each S card enables the D25 to accept 32 digital inputs in the following ranges:

- 5 mA / 12 Vdc
- 5 mA / 24 Vdc
- 48 Vdc
- 120 Vdc
- 250 Vdc
- 10 mA / 24 Vdc

Most of these variations can be ordered with 16 digital inputs. Refer to Page 13, *Part Number* to identify option installed.

Fuses

Each S Card is equipped with a separate wetting supply fuse, located at the left end of the interface connector, as viewed from the rear of the enclosure.

Configuration Options

Each digital input can be configured for one or more of the following functions:

- single digital input
- change of state
- sequence of event (SOE) time-tagging with accuracy of ±1 ms
- three-level programmable software filtering for debounce and chatter
- up to 8 non-consecutive digital inputs per D25 can be configured as pulse accumulators; one of Form A, B, or C at 50 Hz maximum input rate

Other Uses:

- Alarm input
- Tap position indication
- Trip/block protection signaling.

Note

The circuitries of all digital input card options are identical.

For specifications refer to page 6, *Electrical Specifications* section of this User's Guide.

Internal or External Wetting

The 24 Vdc or 48 Vdc digital inputs can use either

- the internal wetting supply, if appropriate, or
- an externally provided source.

Jumpers for selecting digital input wetting supply options are on the DAC Board. Refer to pages 162 to 164 for details.

D25K Digital Output Card

General

For specifications refer to page 6, *Electrical Specifications* section of this Guide.

Features of the K Card include:

- Configurable to one of the following operational types:
  - Momentary
  - Trip/Close
  - Raise/Lower
  - Pulse duration
  - Pulse train
- The digital outputs from the K card can be used as Trip/Close or Raise/Lower configurable in groups of 8 relays.
- Control contact duration is dependent on the D25's software applications, and on protocol support.
- Coil power for the K card is supplied by the D25.
- Digital output supply source is provided externally.
- Quick connect low power relay outputs, and the K card DB-25 connectors, are designed to connect directly to an interposing panel on which final field termination is made.

Fuse

Each K Card is equipped with a separate control voltage fuse, located at the left end of the interface connector, as viewed from the rear of the enclosure.

Secure Operation

- Single component failure protection plus detection prevents false or erroneous control of any coil driver output.
- Performs coil status checks at a minimum rate of twice the minimum contact closure rate on all digital output relays
- Front panel Controls switch prevents accidental operation of digital outputs while unit is being serviced
- Switching the front panel Controls switch into the Local position also disables any KI interposing panel.
- Trip/close output implementations use master trip/master close relays with a select-check-execute scheme.
- Each output has impulse and SWC protection.

Continued on next page

D25K Digital Output Card, Continued

Important!

The D25 K card products contain circuitry that suppress electrical transients and surges. If control outputs are connected to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The leakage current and its magnitude depend on the amplitude of applied voltage. The end user is responsible for the proper application of this product.

Either variant of D25K *must* be used in a D25 enclosure with the correct rear panel

These Modules….			Must Use This Rear Panel
FACE-40	8 chan	517-0414	Part # 953-1010
	16 chan	517-0412	"
	8 chan	517-0458(1)	"
	16 chan	517-0457(1)	"
DB-25	8 chan	517-0396	Part # 953-1007
	16 chan	517-0395	"

An enclosure fitted with the rear panel for either the D25KE or D25K-4Z boards *Will Not* accept the D25K module.

Note 1 Retrofit use only. Contact Customer Service for more details.

D25K-4Z Digital Output Card

General

For specifications refer to Chapter 1: *Technical Specifications.*

Features of the K-4Z Card include:

- Selectable to one of the following operational types:
  - Momentary
  - Trip/Close
  - Pulse duration
  - Pulse train
- The 8 - 4-pole relays switch both supply and return connections to load
- Control output options selected via a 20-pin compression terminal block
- The digital outputs from the card can be used as Trip/Close or Digital Output configurable in 2 groups of 4 relays.
- Control contact duration is dependent on the D25's software applications, and on protocol support.
- Coil power for the K-4Z card is supplied by the D25.
- Digital output supply source is provided externally, with separate inputs for Trip/close and Digital Output modes.
- Output termination is made through a FACE-40 compression terminal block

Note

The D25K-4Z module *Must* be installed into an enclosure that has **Rear Panel Assembly Part # 953-2023** installed.

The rear panel assemblies used by the D25K, KE or KE–4Z modules *will not* accommodate the D25K-4Z module.

Fuses

Each K-4Z Card is equipped with four separate fuses located at the left end of the FACE-40 interface connector, as viewed from the rear of the enclosure.

Secure Operation

- Single component failure protection plus detection prevents false or erroneous control of any coil driver output.
- Performs coil status checks at a minimum rate of twice the minimum contact closure rate on all digital output relays
- Front panel **Controls** switch prevents accidental operation of digital outputs while unit is being serviced
- Trip/close output implementations use a master trip/master close relay with a select-check-execute scheme
- Each output has impulse and SWC protection.

Important!

The D25 K-4Z card products contain circuitry that suppress electrical transients and surges. If control outputs are connected to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The leakage current and its magnitude depend on the amplitude of applied voltage. The end user is responsible for the proper application of this product.

D25KE Digital Output Cards

General

For specifications refer to Chapter 1: *Technical Specifications.*

Features of the KE Cards include:

- Selectable to one of the following operational types:
  - Momentary
  - Trip/Close
  - Raise/Lower
  - Pulse duration
  - Pulse train
- D25KE modules are available in two variants of field wiring terminations:
  - 2 x FACE-40 compression terminal blocks
  - 6 x DB-25 connectors
- The digital outputs from the KE card can be used as Trip/Close or Raise/Lower configurable in 4 groups of 8 relays.
- Control contact duration is dependent on the D25's software applications, and on protocol support.
- Coil power for the KE card is supplied by the D25.
- Digital output control voltage is provided externally.
- Quick connect low power relay outputs, and the KE card DB-25 connectors, are designed to connect directly to interposing panels on which final field termination is made.
- Direct output termination is made through two FACE-40 compression terminal blocks.

Continued on next page

D25KE Digital Output Cards, Continued

Important!

The D25 KE card products contain circuitry that suppress electrical transients and surges. If control outputs are connected to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The leakage current and its magnitude depend on the amplitude of applied voltage. The end user is responsible for the proper application of this product.

Either variant of D25KE *must* be used in a D25 enclosure with the correct rear panel

These Modules….			Must Use This Rear Panel
FACE-40	32 chan	517-0443	Part # 953-1011
	24 chan	517-0450	"
	16 chan	517-0452	(same, only 1 FACE-40 connector)
	8 chan	517-0451	"
DB-25	32 chan	517-0447	Part # 953-1012
	24 chan	517-0453	"
	16 chan	517-0449	"
	8 chan	517-0448	"

An enclosure fitted with the rear panel for either the D25K or D25K-4Z boards *Will Not* accept the D25KE module.

About KE Rear Panels

- All DB-25 D25KE modules are installed in a D25 enclosure that has 6 DB-25 connectors on the backplane, regardless of how many channels the KE board has.

i.e., a 24, 16 or 8 channel DB-25 KE module will have one or more DB-25 connectors that will not be used.

- A KE module installed in an enclosure with FACE-40 connectors will *only* have the connectors necessary to support the number of channels in use.

i.e., 32 and 24 channel KE modules will have 2 – FACE-40 connectors, 16 and 8 channel modules will have only one FACE-40 connector installed.

Fuse

Each KE Card is equipped with a separate control voltage fuse, located at the left end of the interface connector, as viewed from the rear of the enclosure.

Continued on next page

D25KE Digital Output Cards, Continued

Secure Operation

- Single component failure protection plus detection prevents false or erroneous control of any coil driver output.
- Performs coil status checks at a minimum rate of twice the minimum contact closure rate on all digital output relays
- Front panel Controls switch prevents accidental operation of digital outputs while unit is being serviced
- Switching the front panel Controls switch into the Local position also disables any interposing panel.
- Trip/close output implementations use a master trip/master close relay with a select-check-execute scheme
- Each output has impulse and SWC protection.

D25KE–4Z Digital Output Cards

General

For specifications refer to Chapter 1: *Technical Specifications.*

Features of the D25KE–4Z modules include:

- The D25KE–4Z module's relays operate in pairs, allowing the switching of both the supply and return connection to a load.
  - a 32 – relay card has 16 pairs of outputs, or 16 channels
  - a 16 – relay card has 8 pairs of outputs, or 8 channels
- Selectable to one of the following operational types:
  - Momentary
  - Trip/Close
  - Raise/Lower
  - Pulse duration
  - Pulse train
- D25KE–4Z modules are available in only one variant of field wiring terminations:
  - 2 x FACE-40 compression terminal blocks
- The digital outputs from the 16 channel KE-4Z card can be used as Trip/Close or Raise/Lower configurable in 2 groups of 8 pairs of relays.
- Control contact duration is dependent on the D25's software applications, and on protocol support.
- Coil power for the D25KE–4Z is supplied by the D25.
- Digital output control voltage is provided externally.
- Direct output termination is made through two FACE-40 compression terminal blocks.

Important!

The D25KE–4Z module products contain circuitry that suppress electrical transients and surges. If control outputs are connected to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The leakage current and its magnitude depend on the amplitude of applied voltage. The end user is responsible for the proper application of this product.

Either variant of D25KE–4Z *must* be used in a D25 enclosure with the correct rear panel

These Modules….		Must Use This Rear Panel
8 chan	517-0454	Part # 953-1011
16 chan	517-0455	

An enclosure fitted with the rear panel for either the D25K or D25K-4Z boards *Will Not* accept the D25KE–4Z module.

Continued on next page

D25KE–4Z Digital Output Cards, Continued

Note

Both the FACE-40 KE and D25KE–4Z modules use the same rear panel.

Inserting a KE module into a D25 that is configured (using Config Pro) for a KE–4Z module (or vice versa) will not damage the components, but the software of the D25 will prevent the modules from operating.

About KE Rear Panels

- Both 8 and 16 channel D25KE–4Z modules will have 2 x FACE-40 connectors on the rear panel of the enclosure.

i.e., 16 and 8 channel modules will have both FACE-40 connector installed, but the 8 channel card will not use all of the connector's pins.

Fuse

Each KE–4Z module is equipped with a separate control voltage fuse, located at the left end of the interface connector, as viewed from the rear of the enclosure.

Secure Operation

- Single component failure protection plus detection prevents false or erroneous control of any coil driver output.
- Performs coil status checks at a minimum rate of twice the minimum contact closure rate on all digital output relays
- Front panel Controls switch prevents accidental operation of digital outputs while unit is being serviced
- Switching the front panel Controls switch into the Local position also disables any interposing panel.
- Trip/close output implementations use a master trip/master close relay with a select-check-execute scheme
- Each output has impulse and SWC protection.

D25A DC Analog Input Cards

General

The DC Analog Input card incorporates the following features:

- CMOS components for low power consumption
- On-board switch mode power supply
- Capable of handling 16 analog inputs
- All analog inputs are bipolar
- Uses differential solid state multiplexers
- Three high-accuracy reference points, providing ±100% of converter range
- Self-calibration; no adjustments.

Termination

Field termination is through one 40-pin card edge connector positioned on the back panel of the D25.

XCOM Cards - Serial

XCOM Options

XCOM Cards are available in two main types:

- Serial
- Ethernet (802.3)

If the D25 application does not require additional serial or LAN connectivity, the XCOM Card option need not be installed.

General

Dual Serial RS-232/485 XCOM interface characteristics are selected through Config Pro configuration:

- RS-232 or RS-485 selection
- 2-Wire or 4-Wire

Results: The 2 to 4-Wire selection in Config Pro's Device Properties *Does Not* change the physical characteristics of the communication ports.

580-0933 - Special Order *Only*

The 580-0933 type of serial XCOM is available only through special order.

For this modified card, the power for external communication devices, such as modems, is provided by the D25's internal power supply. This violates the isolation specifications of the card, and can lead to two problems:

- an external surge of voltage, such as a lightning strike, can be passed from an external modem into the D25's internal circuitry where damage may occur.
- an inadvertent connection of power to the external 3-pin Phoenix terminal block may cause damage to the D25's power system.

Design Features

The Serial XCOM module supports two independent serial channels:

- The RS-232 option supports TxD, RxD, CTS, RTS, and DCD signals, and associated grounds.
- Supports data rates of 150, 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400 bps.
- Each channel can be programmed to support byte-oriented protocols

LEDs on the front panel of the D25 illuminate to indicate when the IED ports are active, and whether the signal is being transmitted or received.

Radio Keying

The RTS signal of XCOM1 (only) of the Serial XCOM card drives the Radio Keying output.

The radio keying output appears on the **Auxiliary Controls** connector at the rear of the enclosure.

Refer to: Page 173, *Configuring Radio Keying Option* for jumper configuration procedures.

Indicators

LEDs on the front panel of the D25 illuminate when the Tx or Rx signals of the XCOM ports are active.

XCOM Cards - Ethernet

General

The Ethernet XCOM interface cards have two independent channels at the back panel. These interface cards are available in three options:

- 10BASE2
  - Cable: "Thin" Coax RG-58
  - Connection is BNC-type.
  - First and last units on coaxial cable need 50Ω termination
- 10BASE-FL
  - Fiber-optic media
  - ST-type connectors.
  - 6 LED indicators on rear panel of card
- 10BASE-T
  - Unshielded Twisted-Pair (UTP) wire
  - RJ-type connectors used
  - 6 LED indicators on rear panel of card
  - Star network topology using multi-port repeater, or Hub.

For specifications refer to the *Technical Specifications* Chapter of this Guide

Common Features

All signaling and power are supplied from the D25 DAC Board.

Common Indicators

LEDs on the front panel of the D25 illuminate when the Tx or Rx signals of the XCOM ports are active.

Ethernet Addressing

Each channel of the Ethernet cards is assigned a unique network (MAC) addressing number during manufacture.

Note: These addresses are read-only (i.e. *cannot* be modified).

Module Jumper Options

All of the Ethernet XCOM modules have jumpers to select test modes and operational characteristics.

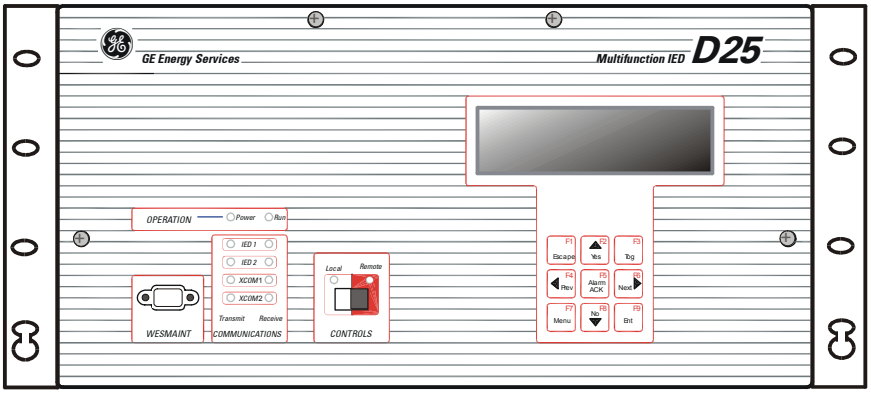
Refer to: Page 174, *Changing Ethernet XCOM Option Jumpers* for details and procedures for changing jumper settings.

Section 3: Display Panels

LCD Panel Overview

LCD Panel Diagram

A Liquid Crystal Display Panel (LCD) option has been made available for applications where alphanumeric front-panel display of analog and digital system input points is desired.



This diagram shows a D25 front panel with the LCD option installed.

Detailed Description

The touch-sensitive keypad below the LCD display can be used to navigate through the display to show a set of select analog and digital input points.

The Data Display panel option is also available in a rack-mounted version that can be linked, using the RS-485 multidrop technique.

Components of an LCD Panel System

A D25 must have these components to support an LCD system:

Hardware:	Part #
– D25 Front Panel	953-3135
– LCD Text Display	540-0248
– LCD Circuit Board Assembly.	540-0256
– Ribbon Cable Assembly	976-0125

Continued on next page

LCD Panel Overview, Continued

Configuring The Software

A D25 fitted with an LCD panel must be equipped with the Data Display DTA (B062) application software to communicate with the panel.

Using Config Pro, specific D25 database input points are mapped into this software.

LCD Hardware Connections

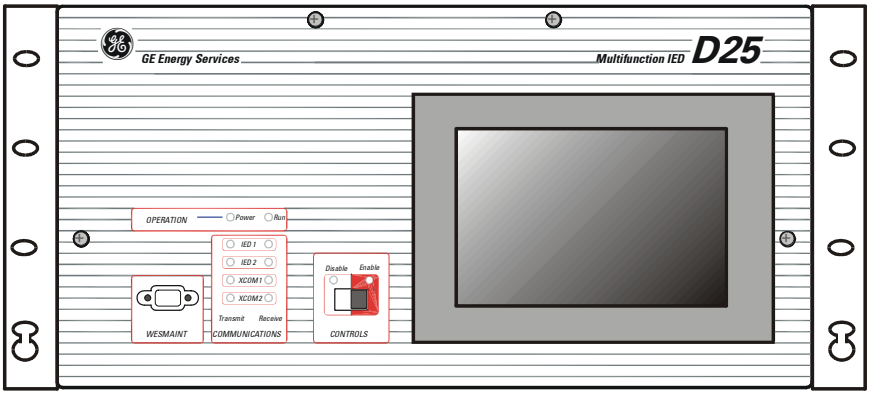
A flat ribbon cable (Part # 976-0125) connects from the LCD card (Part # 540-0256) to the Indicator Switch card (Part # 540-0412) which is also mounted on the inside of the front door of the D25 enclosure.

This cable is both the data and power connection to the LCD card.

Overview of a Graphic Display Panel

GDP Diagram

A Graphic Display Panel (GDP) option has been made available for applications where graphic front-panel display and control of system inputs and outputs is desired.



This diagram shows a D25 front panel with the GDP option installed.

Detailed Description

The touch-sensitive GDP can display a selection of customized graphic displays, each representing a set of analog and digital input and output points.

Using the touch-sensitive screen, an operator can select various displays, select points to monitor and issue control commands

Components of a GDP

A D25 must have these components to support a GDP system:

Hardware:	Part #
– D25 Front Panel	953-3136
– GDP module	580-1186
– Ribbon Cable Assembly	976-0126
– Ribbon Cable Assembly	976-0127
– PSA module	521-0131

Continued on next page

Overview of a Graphic Display Panel, Continued

What Can a GDP be Used For?

The GDP can eliminate the need for discrete substation devices.

For example, the GDP can be used in place of the following devices:

- circuit breaker control switch and semaphore
- disconnector / earth switch and semaphore
- ammeter, and ammeter selector switch
- voltmeter, and voltmeter selector switch
- MW meter
- power factor meter
- alarm annunciator panel
- mimic diagram.

IMPORTANT

A D25 equipped with a GDP has these limitations:

- Only external status wetting can be used when the GDP is installed.
  - the D25's power supply field O/P is used exclusively to power the GDP.
  - connecting another external load to the field O/P will affect isolation, and possibly overload the power supply.
- The GDP reduces the normal -20° to +70°C operational temperature rating of the D25 to 0° to +50°C.
- The D25 is not presently CE marked with the GDP installed.
- The 20-60 V_{DC} D25 power supply is not available with the GDP.

Configuration of a GDP

Configuring a GDP's Software

A D25 fitted with a GDP must be equipped with Modbus DPA (A059) application software to communicate with the GDP. Using Config Pro, some or all of the D25's database points are mapped into this communication software.

Inside the GDP, these points are then mapped into the GDP graphic objects.

Note: Typically, the GDP itself is configured at the GE Energy Services factory prior to shipment. At this time, only GE Energy Services personnel can make changes to the graphic objects and to the points owned by the GDP.

GDP Hardware Connections

When installed, the PSA module (part # 521-0131) is mounted over the right-hand side of the D25's DAC board, where it plugs onto the three sets of digital input wetting jumpers (see page 161 *Low-Voltage Digital Input Card Wetting* for more detail on these jumpers). The PSA taps into the main D25 power supply's field output through these jumpers.

A flat ribbon cable (Part # 976-0126) connects from the PSA card to the Indicator Switch card (Part # 540-0412) mounted on the inside the front door of the D25 enclosure. This cable is the data connection to the GDP.

Another cable (Part # 976-0127) links the PSA card to the GDP. This cable is both the DC power connections from the PSA to the GDP, as well as the RS-485 data interface.

Part II: Installation & External Connections

Overview & Contents

Introduction

This Part of the guide is designed to provide all the information necessary for an installer to install, power-up and test a D25, configure external options, and connect field wiring to a D25.

In This Part

This Part contains the following Chapters and Sections:

Chapter 4: Installing and Connecting Power

Overview & Contents

Introduction

The Sections of this Chapter contain all the information and procedures an installer will require to properly rack-mount and connect power to a D25.

Also included are procedures for the installer to externally verify that the D25 powers up correctly.

IMPORTANT

For accurate and reliable operation of your D25, the practices and recommendations listed in the *Important! Read This First* pages must be considered at all times.

The product warranty may be null and void if these practices and recommendations are not followed.

In This Chapter

This Chapter contains the following Sections and Topics:

Important! Read This First

General

For accurate and reliable operation of your D25, these practices and recommendations must be considered at all times.

- The product warranty may be null and void if these practices and recommendations are not followed.
  - If you have any concerns, please contact GE Energy Services.
- Do not operate the D25 if it has been dropped or damaged.
  - Return it to GE Energy Services for inspection and repair.

Installation Environment

- The D25's enclosure is intended for indoor use primarily to provide protection against accidental contact with the enclosed modules and voltages.
  - Do not place the product in environments where unusual conditions exist (windblown dust and dirt, liquids, etc.) without a secondary protective enclosure.
- Never operate the D25 in the field with its front panel open.
  - Operation with the front panel open may alter product performance specifications, and allow component damage from foreign matter entry.
- Ensure all nuts and screws are tightened securely.

Protection During Installation

Ensure that the D25 is protected from falling debris during installation.

Small metallic particles (such as wire clippings) can fall through the ventilation holes on the top of the unit, possibly damaging or interfering with the safe and reliable operation of the D25.

If covering unit during installation, remove cover before operating to provide adequate cooling airflow.

Power Supply Source

- For correct D25 switching power supply operation, the input voltage must be within specified limits prior to turning on the D25's power switch.
- The D25 DC power supply modules draw an inrush current upon start-up.
  - Ensure the field source can supply this start-up current without overloading.
- Use the D25's field supply outputs *only* when external supplies are not available.
  - Use of an external supply improves the D25's immunity to EMI and increases the D25's power supply efficiency.

Continued on next page

Important! Read This First, Continued

Power Fusing

- Always replace fuses with the same type and rating used by GE Energy Services.
  - The fuse types and ratings are stated on page 155, *Fuse Replacement*.
- Always fuse-protect field power sources.

Grounding and Shielding

Surge and noise suppression components used on the D25 are designed to conduct during transients to prevent nuisance operation or damage to internal components.

- To properly shunt transients from line to ground, the D25's earth ground stud must be connected to a low impedance ground.
  - When making ground connections, ensure that all surfaces that are used for grounding are free of dirt, residue and corrosion.
  - The ground wire must be the largest gauge of all wires used for field termination. A 12 AWG (2.5 mm^2) green and yellow wire is recommended.
- Ensure that cable shields are grounded at either the D25 auxiliary ground stud or at the field equipment.
  - Do not ground the shields at more than one point because a potential difference may exist between grounds causing ground loops and undesirable noise sources.
- To prevent electromagnetic interference from upsetting D25 operation, use cables with an over-all cable shield.
- To prevent interference with communications, route all communication cables away from power carrying cables.

Communications Ports and Connections

- The D25 may be configured to have low-voltage power available on its serial ports for powering external communication equipment.
  - Verify all communication cable connections prior to start-up to avoid damaging the D25 or interface equipment.
- The serial ports are protected with surge and noise suppression components.
  - Always shield communication cables and make them as short as possible.

Operation in Residential Areas

The D25 generates radio frequency energy and, if not installed and used in accordance with the instructions provided in this guide, may cause harmful interference to radio communications.

Operation of the D25 in a residential area without adequate shielding may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Section 1: Installation

Physical Mounting

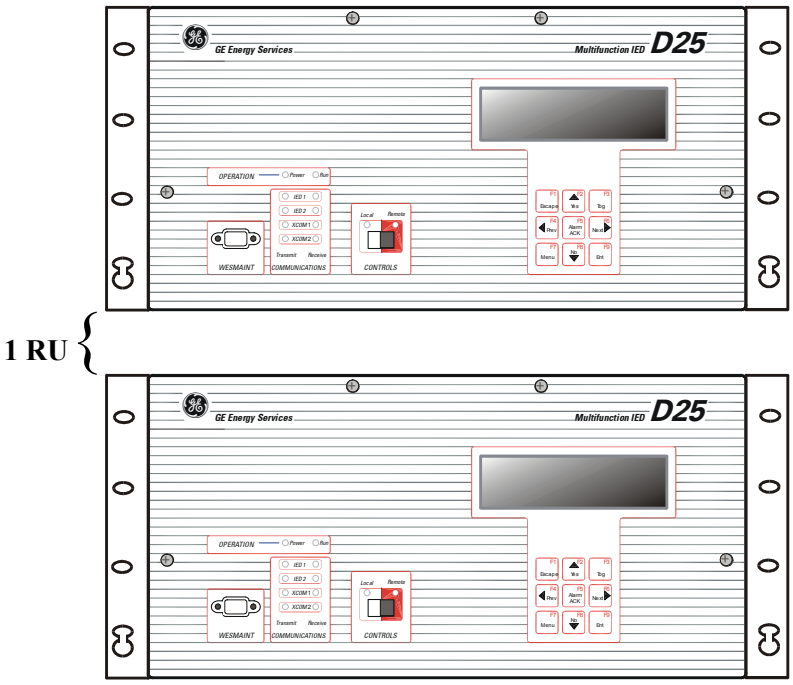
19 Inch Rack

1. Align the D25 in its proper position in a 19 inch mounting rack.
2. Install and tighten the four rack screws, holding the D25 firmly in place in the rails of the mounting rack.
3. Connect all power and field wiring to the back of the D25, following the instructions in this *Installation & Maintenance Guide*.

Rack Spacing

When mounting multiple D25s in a rack (or if mounting a D25 in a rack with other equipment) verify that there is at least one rack unit (RU) space above and below the D25 to allow for cooling airflow.

– (1 RU = 1.75 inches)



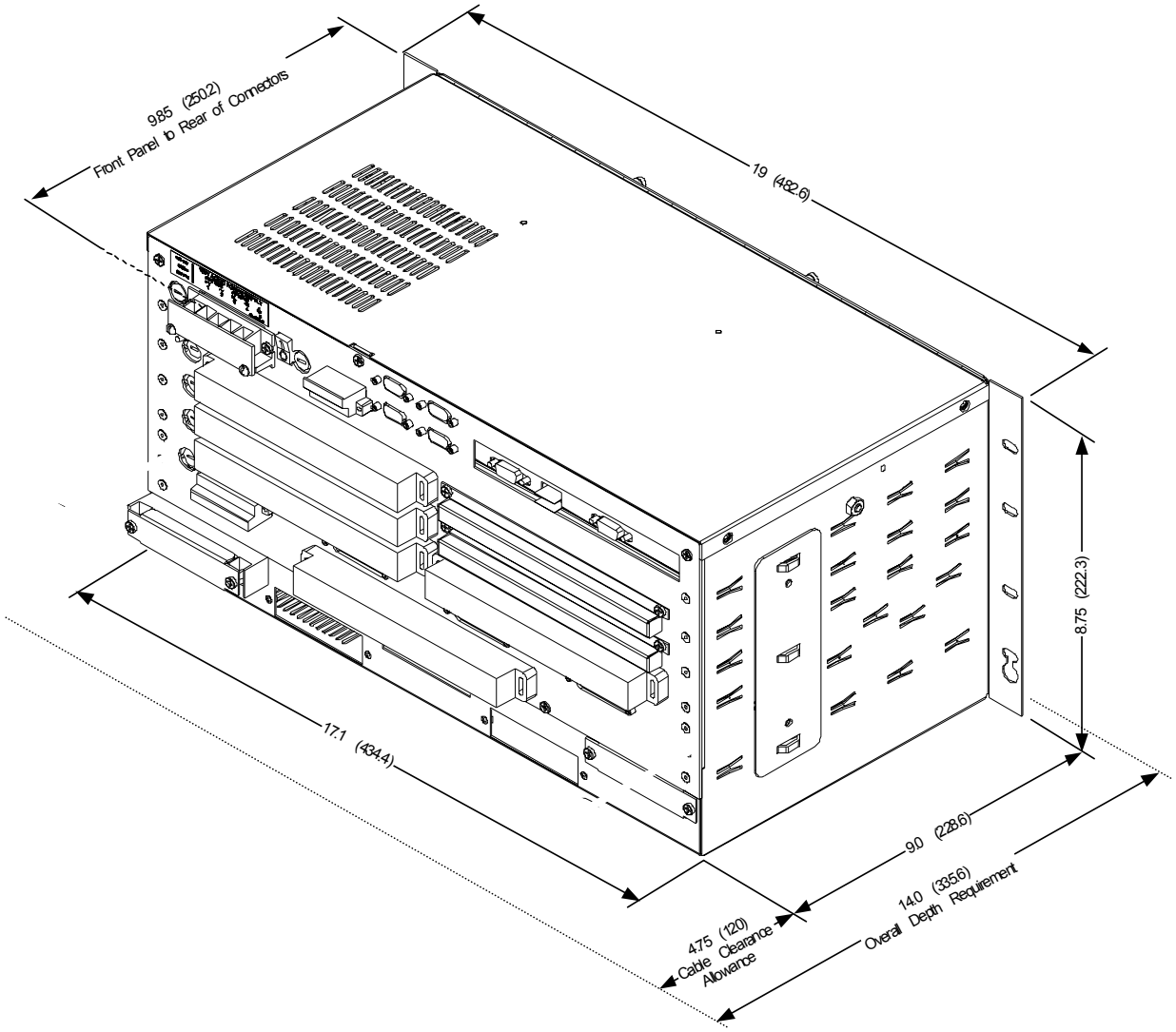
Dimensions and Clearances

Mounting and Clearance Diagram

The diagram below shows the exterior dimensions of the standard D25 enclosure.

Allow approximately 14 inches (335 mm) of total cabinet depth to provide clearance for hardware on the front panel, and interface cables on the rear.

Note: All dimensions are shown as *Inches (millimeters)*



D25 Wiring Rod Installation

Background

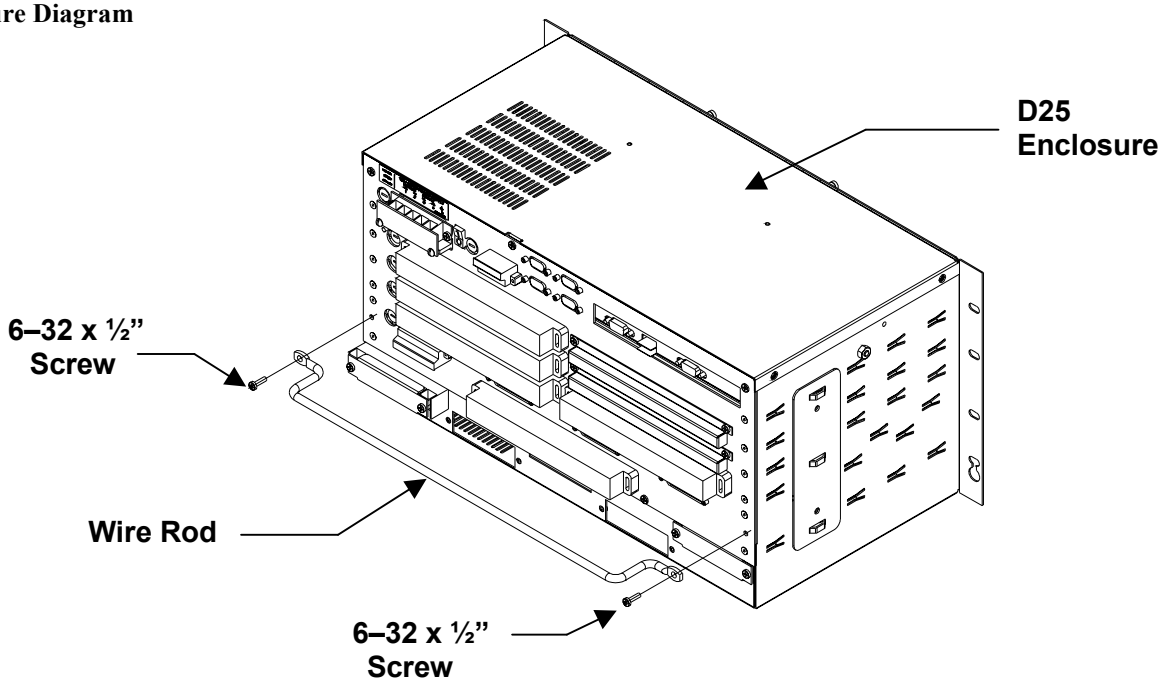
The optional D25 Wiring Rod assembly is designed to help support field wiring, to prevent undue stress on the connectors on the rear of the D25.

Parts Required

Wire Rod Assembly, PN 953-4029

2 - 6-32 - ½ inch LG Screws (Screws removed from enclosure may be re-used, if they are ½ inch long)

Enclosure Diagram



Procedure

Follow these steps to install the D25 Wiring Rod Assembly, PN 953-4029.

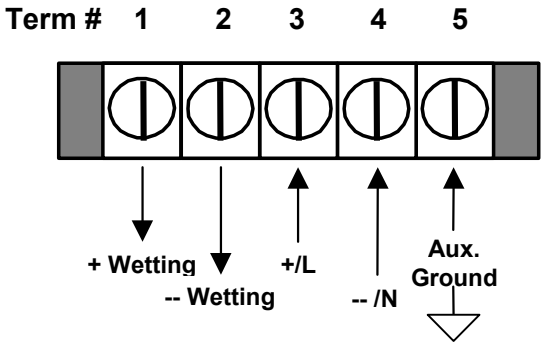
Step	Action
1	Remove (2) screws from locations show on diagram. Retain screws.
2	Position Wire Rod onto rear panel as shown.
3	Install 6-32 x ½" LG screws.

Section 2: Connecting Power

Back Panel Connections

Power Supply

The back panel of the D25 will have a label outlining the actual power connection points for the Power Supply option installed.



+ Wetting Supply Output

Either +24V or +48V according to the power supply option specified at time of ordering the D25.

- Wetting Supply Output

Either -24V or -48V according to the power supply option specified at time of ordering the D25.

+/L Input

- Positive if using DC power supply
- Line if AC power supply

-/N Input

- Negative if DC power supply
- Neutral if AC power supply

Grounding

- Connect the protective ground stud before operating the D25
- Use the Auxiliary ground pin for shielding

External Overcurrent Protection

The D25 power supply input must be externally protected as follows:

- AC mains supplies shall be fused at no more than 15A, or
- DC mains supplies shall be fused at no more than 5A

Continued on next page

Back Panel Connections, Continued

Power Connection Procedure

The procedure for connecting power source is as follows:

Step	Action
1	Unscrew the terminal block cover. Set screws aside.
2	Remove the terminal block cover.
3	If using DC power supply, connect the DC power supply, observing the correct polarity, to the +/L and -/N connection points on the terminal block TB1.
4	If using AC power supply, connect the AC line connection to the +/L connection point, and AC neutral connection to the -/N connection points on the terminal block.
5	Connect protective ground wire to the ground stud on the rear panel identified by this symbol:  Note: The ground wire must be the largest gauge of all wires used for field termination. A 12 AWG green and yellow wire is recommended.
6	Replace terminal block cover

- Power Source must be from a branch circuit that is protected by ***no more*** than a 15 Amp breaker
- ***Do not*** use wire larger that 14 AWG for the power connections.
- Auxiliary Ground terminal at the power supply terminal block ***must not*** be used as a safety ground connection.

Make sure that the metal case of the D25 is grounded at the protective ground stud located at the top-left corner of the rear of the enclosure.

Connection must be provided with separate green/yellow wire connected between the D25 and the protective earth system of the facility.

Chapter 5: Digital Input Configurations

Overview & Contents

Introduction

This Chapter first provides the information that an installer will need to check that the digital input module(s) installed in the D25 are suitable for the inputs that will be connected.

The rest of the Chapter is devoted to external optioning and field wiring of the digital input modules.

Note: Procedures for the internal jumper selection of digital input wetting sources are found in Chapter 11: *Inside the D25*

In This Chapter

This Chapter contains the following Topics:

About Digital Input Modules

Up to 3 Cards

The D25 can have up to 96 digital inputs in three banks of 16 or 32:

- Digital Inputs 1 to 32 are on connectors A and B
- Digital Inputs 33 to 64 are on connectors C and D
- Digital Inputs 65 to 96 are on connectors E and F

Wetting Types

All digital inputs require an input voltage signal large enough to turn on an optical switch. The input levels required for each S Card type are shown in the table below.

- The D25 Low Voltage Digital Input cards can each be set to use:
  - Internal wetting.
  - External wetting.
  - Externally applied input voltage. (Voltage Detect)
- The D25 High Voltage Digital Input cards can each be set to use:
  - External wetting.
  - Externally applied input voltage. (Voltage Detect)

Note

The High Voltage Digital Input cards are not connected to the wetting selection jumpers shown on pages 162 or 163.

For safety, all wetting is provided externally on high voltage cards.

Digital Input Thresholds

The following table shows the on and off state thresholds for each of the listed D25 S card options. Use this information to determine the suitability of the installed option, before connecting field wiring.

In particular, verify that inputs do not exceed the maximum overload voltage, or damage to the card may result.

Card Type	32 Input Part #s	16 Input Part #s	On Threshold	Off Threshold	Overload Voltage
Low Voltage Digital Input Cards					
12V / 5 mA	517-0427	517-0433	>8 V	<4 V	16.8 V
24V / 5 mA	517-0402	517-0432	>18 V	<10 V	33.6 V
24V / 10 mA	517-0425	N/A	>18 V	<10 V	33.6 V
48V / 5 mA	517-0403	517-0431	>35 V	<16 V	67.2 V
High Voltage Digital Input Cards					
120V / 0.75 mA	517-0426	517-0434	>80 V	<40 V	144 V
250V / 0.75 mA	517-0428	517-0435	>160 V	<80 V	300 V

Load/Burden

- Burden for each digital input is in the range of 0.75 mA to 10 mA
- Maximum power dissipation — 0.5 W per input

Continued on next page

About Digital Input Modules, Continued

Note 2

The inputs of all variants of the S Cards are *not* polarity sensitive (i.e., inputs are bipolar), and are isolated from the D25's internal power supply.

Fuse Monitoring

D25 S modules include circuitry that detects the presence of wetting voltage *after* it has passed through the fuse F1.

Software in the D25 Plant I/O Subsystem, P097 V2.30 or greater, responds to the signals from each of the three S modules and creates pseudo digital inputs that can be seen in the D25's System point Database.

If fuse F1 opens, or the wetting voltage is removed from the digital input module for any reason, the pseudo DI for that module will change state, providing an alarm. If any S module is not installed, or removed, the pseudo DI point will remain in the *Off* state.

Note: Fuse monitoring can only detect a wetting voltage if the S module is configured for *internal* or *external* wetting.

If the module is configured for *voltage detect* the fuse monitoring circuitry will not sense any wetting voltage, and therefore remain in the *Off* state

Digital Input Module Configuration

Digital Input Field Connections

Field wiring for all variations of Digital Input modules are made through two FACE-40 connectors for each module on the backplane of the D25 enclosure.

These connectors are provided *only* if a module is installed in the D25 when ordered.

Example: If a D25 is ordered with one 32-point module, only connectors A and B will be present on the backplane of the enclosure.

High Voltage Digital Input Wetting Selection

When using one or more high voltage digital input cards, the choice of external wetting supply source, or voltage detect input *must* be provided externally for each of the cards independently. Internal wetting option is not available.

If external wetting supply is to be used:

- connect external wetting supply to pins 1 and 2 on FACE-40 connector A, C and/or E where the High Voltage module(s) is installed

If voltage detect input is to be used:

- connect (jumper) pins 1 and 2 on connector A, C and/or E for each module(s)

While all of the 32 inputs are bipolar and not polarity sensitive, the "B" sides of all inputs are linked together internally by low-impedance resistors (0 to 10Ω).

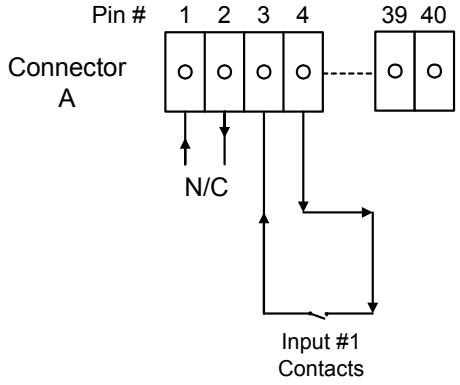
- Use care when connecting multiple external power sources.

For external wetting, the three digital input modules can have independent wetting configurations and wetting voltage sources.

Internal Wetting

Is the term used when the voltage applied to the inputs originates from the D25's own power supply.

The digital input is "turned-on" simply by closing a contact across the two input termination points. This diagram shows the connections for digital input point number 1.



Note: This option is available for 24 and 48V low-voltage DI cards, *only*.

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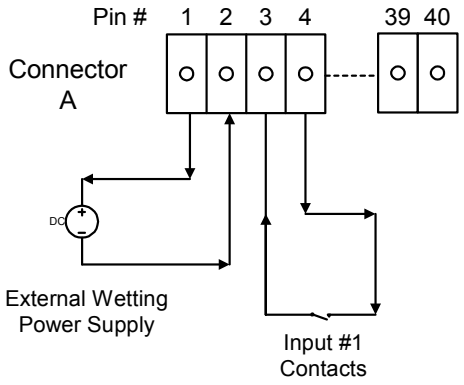
Digital Input Module Configuration, Continued

External Wetting

The operation of the digital inputs is essentially the same as for Internal Wetting, except that the voltage that is switched at the input terminals is supplied by an external source. The external power source is connected to pins 1 and 2 of connector(s) A, C or E, for each of the three Digital Input cards respectively.

This diagram shows the connections for digital input point number 1.

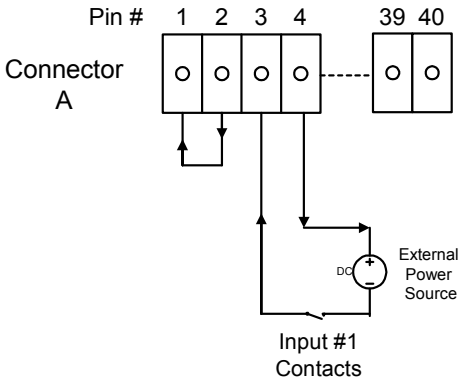


Voltage Detect

In this type of input, the D25 does not provide the wetting power source, from either its own power supply, or from an external battery. The inputs can be considered a voltage meter, sensing a voltage applied to each input independently. Note that pins 1 and 2 of connector(s) A, C or E are jumpered for each board using this configuration.

If using more than one external power source, they must share a common return, and it must be connected to the "B" input termination for each input point.

This diagram shows the connections for digital input point number 1.



Digital Input Connections

The tables on the following pages show the connector pinouts for each of the three Digital Input modules.

Continued on next page

Digital Input Module Configuration, Continued

Digital Inputs Pinout: 1-32

The following table shows the pinouts for Digital Inputs 1 through 32.

Pin	Connector A	Connector B
1	Wetting Voltage	Reserved
2	Wetting Voltage	Reserved
3	DI 1A	DI 17A
4	DI 1B	DI 17B
5	DI 2A	DI 18A
6	DI 2B	DI 18B
7	DI 3A	DI 19A
8	DI 3B	DI 19B
9	DI 4A	DI 20A
10	DI 4B	DI 20B
11	DI 5A	DI 21A
12	DI 5B	DI 21B
13	DI 6A	DI 22A
14	DI 6B	DI 22B
15	DI 7A	DI 23A
16	DI 7B	DI 23B
17	DI 8A	DI 24A
18	DI 8B	DI 24B
19	Reserved	Reserved
20	Reserved	Reserved
21	Reserved	Reserved
22	Reserved	Reserved
23	Reserved	Reserved
24	Reserved	Reserved
25	DI 9A	DI 25A
26	DI 9B	DI 25B
27	DI 10A	DI 26A
28	DI 10B	DI 26B
29	DI 11A	DI 27A
30	DI 11B	DI 27B
31	DI 12A	DI 28A
32	DI 12B	DI 28B
33	DI 13A	DI 29A
34	DI 13B	DI 29B
35	DI 14A	DI 30A
36	DI 14B	DI 30B
37	DI 15A	DI 31A
38	DI 15B	DI 31B
39	DI 16A	DI 32A
40	DI 16B	DI 32B

Digital Input Module Configuration, Continued

Digital Inputs Pinout: 33-64

The following table shows the pinouts for Digital Inputs 33 through 64.

Pin	Connector C	Connector D
1	Wetting Voltage	Reserved
2	Wetting Voltage	Reserved
3	DI 33A	DI 49A
4	DI 33B	DI 49B
5	DI 34A	DI 50A
6	DI 34B	DI 50B
7	DI 35A	DI 51A
8	DI 35B	DI 51B
9	DI 36A	DI 52A
10	DI 36B	DI 52B
11	DI 37A	DI 53A
12	DI 37B	DI 53B
13	DI 38A	DI 54A
14	DI 38B	DI 54B
15	DI 39A	DI 55A
16	DI 39B	DI 55B
17	DI 40A	DI 56A
18	DI 40B	DI 56B
19	Reserved	Reserved
20	Reserved	Reserved
21	Reserved	Reserved
22	Reserved	Reserved
23	Reserved	Reserved
24	Reserved	Reserved
25	DI 41A	DI 57A
26	DI 41B	DI 57B
27	DI 42A	DI 58A
28	DI 42B	DI 58B
29	DI 43A	DI 59A
30	DI 43B	DI 59B
31	DI 44A	DI 60A
32	DI 44B	DI 60B
33	DI 45A	DI 61A
34	DI 45B	DI 61B
35	DI 46A	DI 62A
36	DI 46B	DI 62B
37	DI 47A	DI 63A
38	DI 47B	DI 63B
39	DI 48A	DI 64A
40	DI 48B	DI 64B

Digital Input Module Configuration, Continued

Digital Inputs Pinout: 65-96

The following table shows the pinouts for Digital Inputs 65 through 96.

Pin	Connector E	Connector F
1	Wetting Voltage	Reserved
2	Wetting Voltage	Reserved
3	DI 65A	DI 81A
4	DI 65B	DI 81B
5	DI 66A	DI 82A
6	DI 66B	DI 82B
7	DI 67A	DI 83A
8	DI 67B	DI 83B
9	DI 68A	DI 84A
10	DI 68B	DI 84B
11	DI 69A	DI 85A
12	DI 69B	DI 85B
13	DI 70A	DI 86A
14	DI 70B	DI 86B
15	DI 71A	DI 87A
16	DI 71B	DI 87B
17	DI 72A	DI 88A
18	DI 72B	DI 88B
19	Reserved	Reserved
20	Reserved	Reserved
21	Reserved	Reserved
22	Reserved	Reserved
23	Reserved	Reserved
24	Reserved	Reserved
25	DI 73A	DI 89A
26	DI 73B	DI 89B
27	DI 74A	DI 90A
28	DI 74B	DI 90B
29	DI 75A	DI 91A
30	DI 75B	DI 91B
31	DI 76A	DI 92A
32	DI 76B	DI 92B
33	DI 77A	DI 93A
34	DI 77B	DI 93B
35	DI 78A	DI 94A
36	DI 78B	DI 94B
37	DI 79A	DI 95A
38	DI 79B	DI 95B
39	DI 80A	DI 96A
40	DI 80B	DI 96B

Chapter 6: Digital Output Configurations

Overview & Contents

Introduction

Each of the Sections of this Chapter is devoted to the configuration of one of the control module variations. In all cases, all hardware optioning of control modules is performed externally.

In This Chapter

This Chapter contains the following Sections and Topics:

Continued on next page

Overview & Contents, Continued

In This Chapter (continued)

About Digital Output Modules

Two Modes of Operation

All variations of D25 control modules can be configured for two basic modes of operation:

- Trip/Close (T/C)
- Digital Output (DO)

Any other type of operation, such as Raise/Lower, will use the Digital Output hardware configuration.

T/C or DO (R/L) Sensing

The D25 software will detect what type of digital output command has been received, and will use the Master Trip and Master Close relays when appropriate.

External jumpering is provided to route the external Control Voltage through the correct relays for each mode of operation.

Fuse Monitoring

Control modules include circuitry that detects the presence of control voltage on the load side of the fuses. Software in the D25 Plant I/O Subsystem, P097 V2.30 or greater, responds to the signal from the control module and creates a pseudo digital input that can be seen in the D25's System Point Database.

If a fuse opens, or the control voltage is removed from the digital output module for any reason, the pseudo digital input (DI) for that module will change state, providing an alarm.

If the control module is not installed, or removed, the pseudo DI point will remain in the *Off* state.

Note 1: The fuse monitoring circuitry can only detect a control voltage above approximately 12 Vdc. If the control voltage is less than this level, the fuse monitoring circuitry will not sense any voltage, and the pseudo DI point will remain in the *Off* state.

Note 2: Fuse monitoring works with (+)ve or (-)ve grounded systems.

Note 3: For D25s with Plant I/O Version 2.30, the fuse-monitoring feature will only work with DC control voltages. Versions greater than 2.30 support AC control voltage monitoring on the D25 KE module *only*.

Caution

The fuse monitoring circuitry has been engineered to detect control voltages up to the supported maximum specifications of the module.

Do not exceed this level of control voltage. Damage to the module may result.

Configuring Fuse Monitoring

D25K, KE or KE-4Z modules do not require hardware configuration to use the fuse-monitoring feature. D25K-4Z modules may require external jumpering for the feature to operate properly. Refer to page 102 for a detailed explanation.

Section 1: D25K Control Module

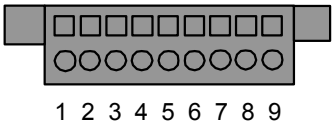
D25K Controls Module External Connections

Background

Note: This section discusses the configuration of the D25K control board option, *only*. Refer to the following sections for other control board types.

D25K Board Control Function Terminal Block – P1

Phoenix 9-pin terminal block – P1 Pinout:



Gen. 1 Pin Labels	Gen. 2 P1 Pin	Signal
P1	1	Control Voltage
P2	2	Control Voltage Return
P3	3	MT (Master Trip)
P4	4	+Vc
P5	5	Jmp 1
P6	6	MT (Master Trip)
P7	7	+Vc
P8	8	Jmp 2
P9	9	MC (Master Close)

Note

Earlier enclosures of the D25 labeled the **Control Function** terminal block's pins as P1 through P9

Important

Control voltage *must* be provided if the D25K board is connected to Interposing relays such as the D20 or D25 KI panels.

Continued on next page

D25K Controls Module External Connections, Continued

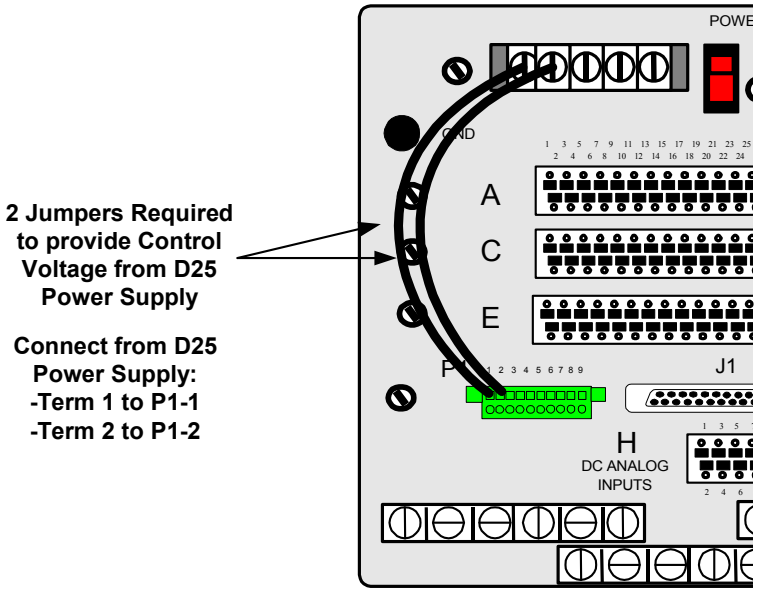
Control Voltage Connections

Control voltage can be supplied by either:

- an external power supply, or
- the D25's power supply

In either case, the control voltage can be connected to P1 pins 1 and 2, where it will be routed through the K-board relays, the backplane connectors, and out to the external loads or interposing relays.

The following diagram shows how the D25's internal power supply can be connected to provide control voltage.



D25K Trip/Close Configuration

Background

Through the use of "Master" relays, the 16 digital outputs can be configured as two groups of eight Trip/Close pairs. i.e., 32 output connections.

- The Control Voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum. See page 6 for specifications of control outputs.

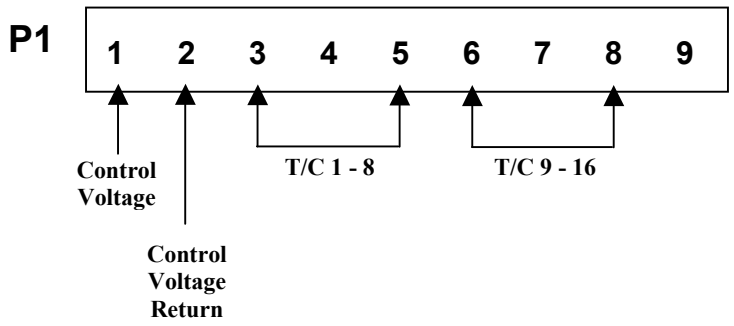
Use jumper wires on the Control Function Terminal block to configure the first group:

- connect between MT (P1-3) and JMP1 (P1-5)

To configure the second group

- connect between MT (P1-6) and JMP2 (P1-8)

P1 connections for Trip/Close



Schematic of Trip/Close Jumper Options

The following schematic shows an example of the flow of the Control Voltage current through the Master and Point relay contacts for the first 8 Trip/Close output pairs.

The Master Close relay is permanently connected to all point relay Close contacts. The Master Trip relay must be connected to the point relay Trip contacts by connecting the jumper shown from P1-3 to P1-5.

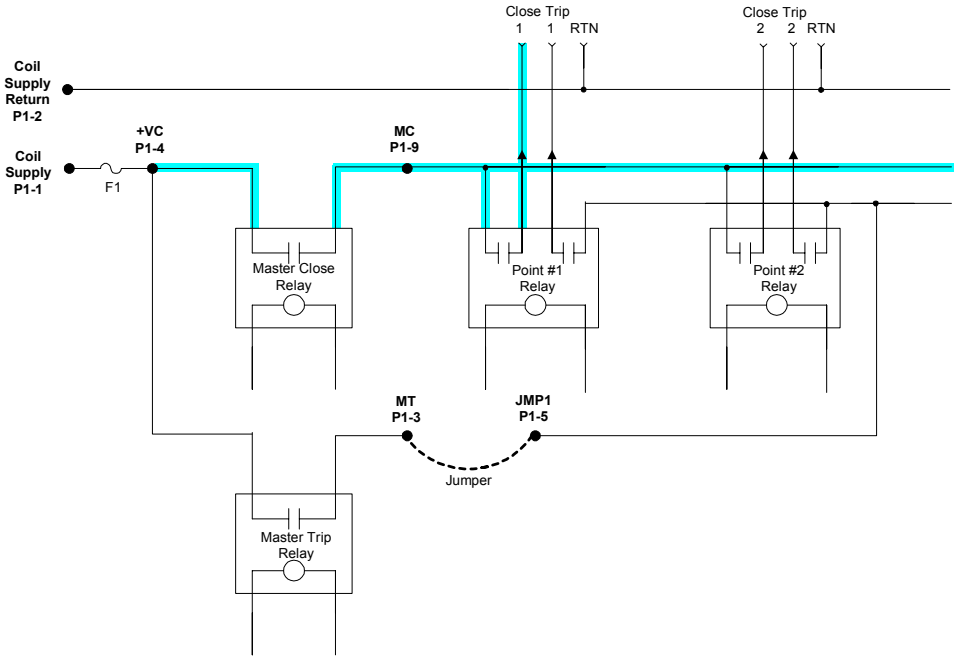
The shadow shows the current flow when **Close 1** output is operating.

You can monitor the output voltage by metering between the Control Voltage Return (P1-2) and the Trip or Close output termination.

Continued on next page

D25K Trip/Close Configuration, Continued

Schematic of "Close" Operation Control Voltage Path



D25K Raise/Lower Configuration

Background

The 16 O/P option can be configured for two groups of four Raise/Lower pairs.

- The Control Voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum. See page 6 for specifications of control outputs.

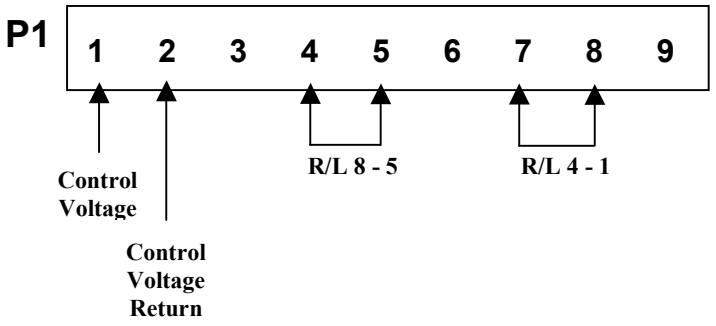
Use jumper wires on the Control Function Terminal block to configure the first group:

- connect from +VC (P1-4) to JMP1 (P1-5)

To configure the second group:

- connection from +VC (P1-7) to JMP2 (P1-8)

P1 connections for Raise/Lower



Note

Raise/Lower Digital Outputs are numbered in the reverse order. i.e., Lower point #1 is Digital Output point #16

Schematic

The following schematic shows an example of the flow of the Control Voltage current through the relay contacts for the first pair (R/L 8) of Raise Lower outputs.

The Master relays must be bypassed by connecting the jumper shown from P1-4 to P1-5.

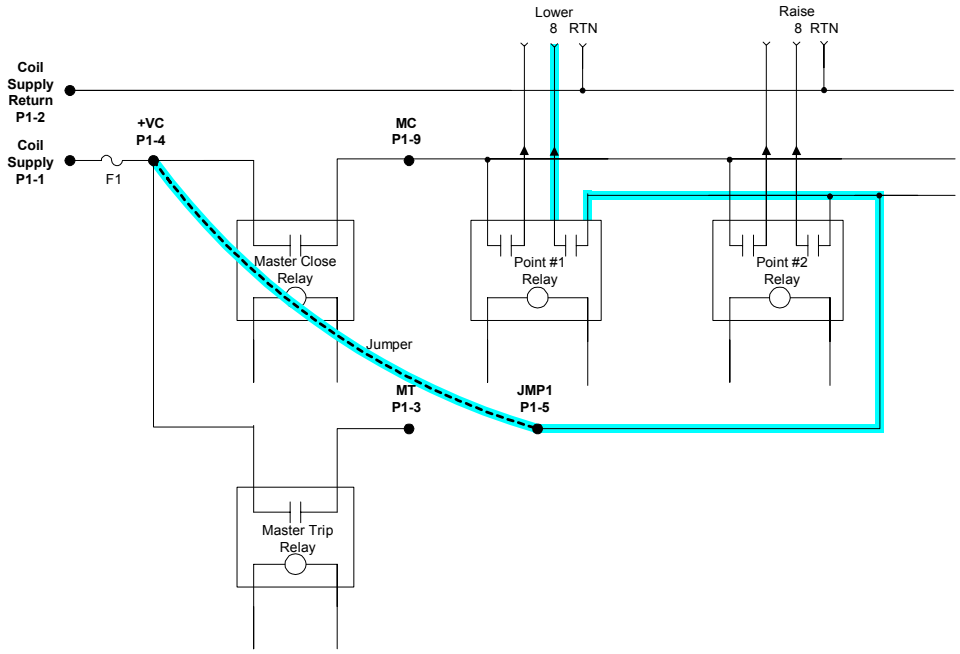
The shadow shows the current flow when **Lower 8** output is operating.

You can monitor the outputs by metering between the Control Voltage Return (P1-2) and the Raise or Lower output termination.

Continued on next page

D25K Raise/Lower Configuration, Continued

Schematic of "Lower" Operation Control Voltage Path



Note

All digital outputs have a common Control Voltage and Control Voltage Return.

D25K Combined R/L and T/C

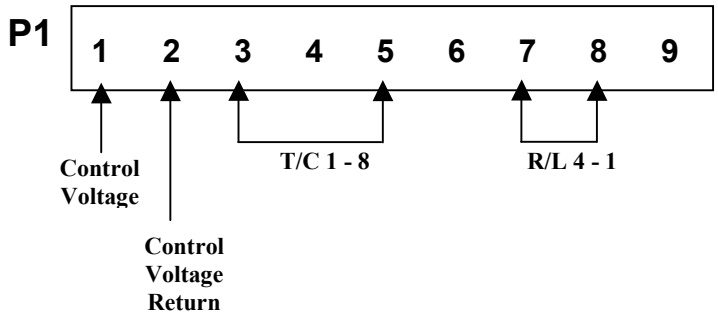
Background

Trip/Close and Raise/Lower digital outputs can be used on the same D25 unit.

The D25 must have a 16-point card installed.

In the following example, the first 8 digital outputs are configured as trip/close, and the second 8 are configured as 4 raise/lower pairs.

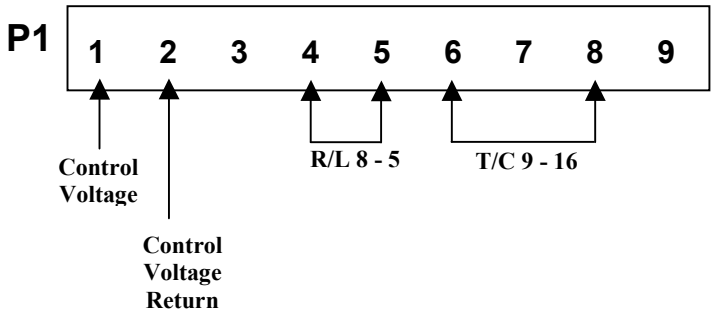
P1 connections for Combined Raise/Lower and Trip/Close



Combined T/C and R/L

This example shows the J3 jumpers when the first 8 digital outputs are configured as 4 raise/lower pairs, and the second 8 outputs are configured as trip/close.

P1 connections for Combined Trip/Close and Raise/Lower



D25K Module - Digital Output Connections

Two Connector Options

Two digital output configuration options are available:

- the 40-pin FACE-40 compression-type connector
- a set of three DB-25-F connectors.

FACE-40 Option

is used where:

- the D25 Digital Outputs will be directly connected to field equipment.
- the termination has the electrical isolation and surge withstand characteristics necessary for direct connection.

FACE-40 Pinout:

The following table shows the pinouts for Digital Outputs 1 through 16.

Note: For 8-output K cards, pins 21 through 40 will not be used.

Pin	Signal	Pin	Signal
1	CLS 1	2	TRP 1 / Raise 8
3	CLS 2	4	TRP 2 / Lower 8
5	CLS 3	6	TRP 3 / Raise 7
7	CLS 4	8	TRP 4 / Lower 7
9	CLS 5	10	TRP 5 / Raise 6
11	CLS 6	12	TRP 6 / Lower 6
13	CLS 7	14	TRP 7 / Raise 5
15	CLS 8	16	TRP 8 / Lower 5
17	Control Voltage Return	18	Control Voltage Return
19	Control Voltage Return	20	Control Voltage Return
21	CLS 9	22	TRP 9 / Raise 4
23	CLS 10	24	TRP 10 / Lower 4
25	CLS 11	26	TRP 11 / Raise 3
27	CLS 12	28	TRP 12 / Lower 3
29	CLS 13	30	TRP 13 / Raise 2
31	CLS 14	32	TRP 14 / Lower 2
33	CLS 15	34	TRP 15 / Raise 1
35	CLS 16	36	TRP 16 / Lower 1
37	Control Voltage Return	38	Control Voltage Return
39	Control Voltage Return	40	Control Voltage Return

Continued on next page

D25K Module - Digital Output Connections, Continued

DB-25 Option

The DB-25 connector option is designed for use specifically with the WESTERM D20 KI Interposer Relay Panels, part # 517-0166, and 517-0167

For these connections use a multi conductor shielded DB-25 cable assembly.

Note

Ensure that the multi-conductor cable's shield drain wire is connected to pin 17 of the WESTERM D20 KI DB-25 connector.

Pin 17 of the D25K DB-25 connector is not connected internally, and therefore, cannot be used as a drain connection.

FACE-40 Option

The FACE-40 connector option is designed for use specifically with the WESTERM D25 KI Interposer Relay Panel, part # 517-0462

Trip/Close Connections

The D25K module requires either two WESTERM D20 KI Interposing Relay Panels or two WESTERM D25 KI Interposing Relay Panels to support 16 pairs of Trip/Close digital outputs.

- For both D20 KI relay panels, a single jumper in Z1 must be installed to provide a return path for the control voltage.

For the first group of eight digital outputs:

- Attach the cable to J2 of the D25K and to J2 of the first WESTERM D20 KI Interposing Relay Panel.

For the second group of eight digital outputs:

- Attach the cable to J3 of the D25K and to J2 of the second WESTERM D20 KI Interposing Relay Panel.

Note: While J3 connector is present, it will not be used with 8-output K cards.

Note

For Trip/Close operation, the cables used to connect the D25 control outputs to the WESTERM D20 KI Interposing Relay Panels must have all DB-25 pins connected end-to-end.

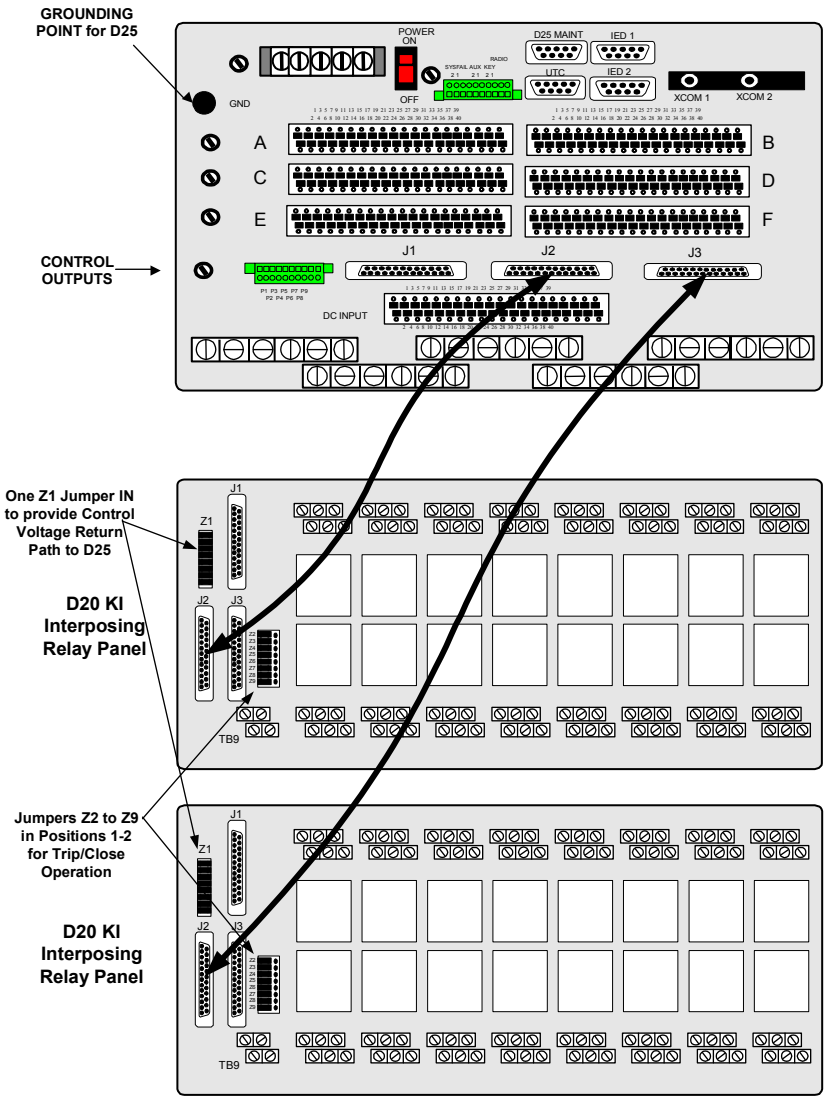
- Use GE Energy Services part number 977-0208, or equivalent.

D25K Module - Connection Diagrams

Trip/Close Connection Diagram

The diagram below illustrates the connections used when configuring for Trip/Close operation using two-D20 KI interposing relay panels.

Note: When using an 8-output K card, the second KI module and interconnecting cable are not used.



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D25K Module - Connection Diagrams, Continued

Raise/Lower

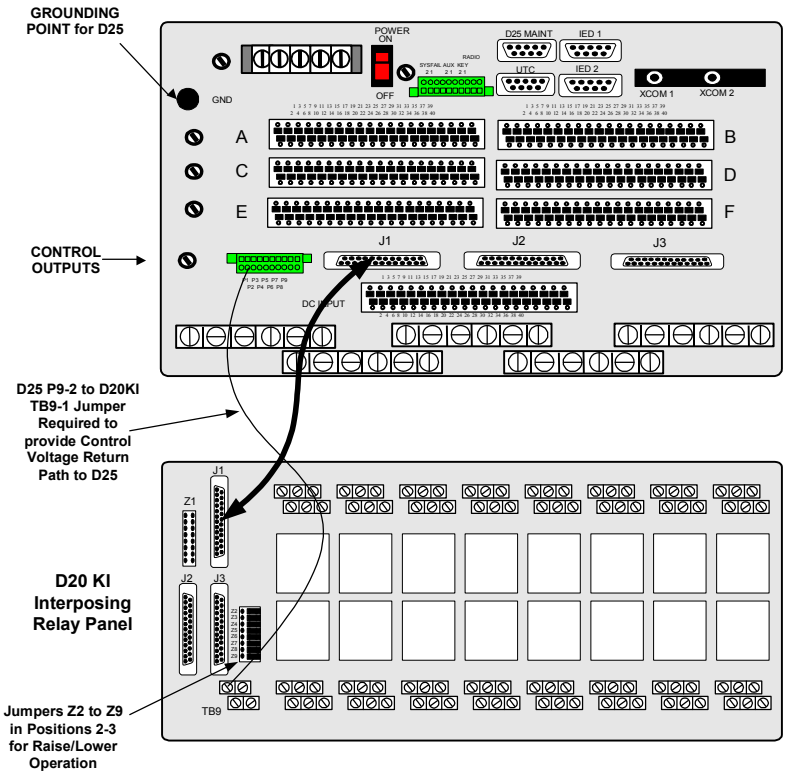
The D25K module requires a single WESTERM D20 KI interposing relay panels to support 8 pairs of Raise/Lower digital outputs. To connect the digital outputs:

- Attach the cable to J1 of the D25K and to J1 of the WESTERM KI interposing relay panel.
- Connect a Control Voltage Return connection from the D25's P1-2 to the D20 KI's TB9-1
- Set Jumpers Z2 – 9 to 2 - 3

Raise/Lower Connection Diagram

The diagram below illustrates the connections used when configuring for Raise/Lower operation using a single D20 KI interposing relay panel.

Note: When using an 8-output K card, the second KI module and interconnecting cable are not required, and only the first 8 KI board relays will be operational.



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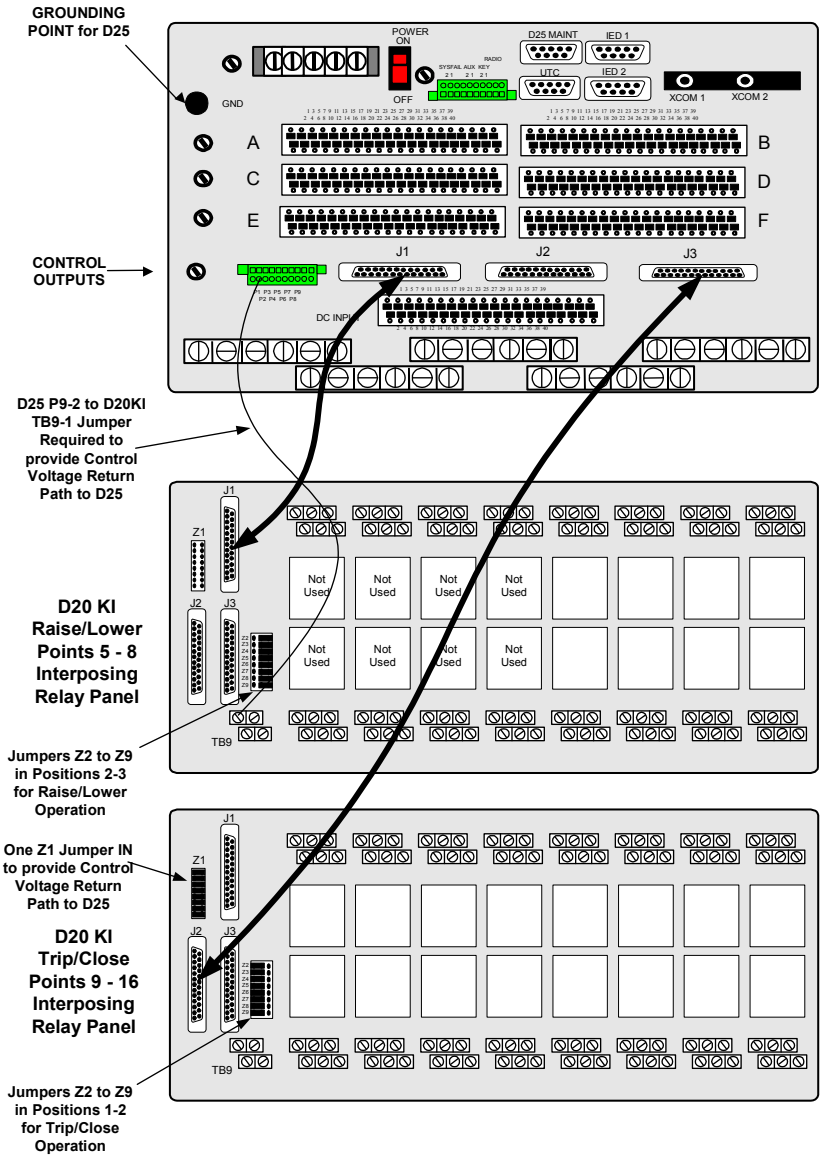
D25K Module - Connection Diagrams, Continued

Combined T/C and R/L

This diagram outlines the options and connections required when the first 8 outputs are configured as Raise/Lower, and the last 8 are Trip/Close.

Note: This configuration can only be set up using a 16-output K card.



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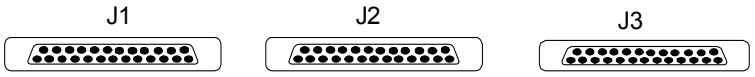
D25K Module - Connection Diagrams, Continued

DB-25 Connector Pinouts:

The following table shows the pinouts for Digital Outputs 1 through 16.

Note: For 8 output K cards, connector J3 will be present, but not functional.



Pin	J1 R/L 1-8	J2 T/C 1-8	J3 T/C 9-16
1	Raise 8	TRP 1	TRP 9
2	Lower 8	CLS 1	CLS 9
3	Raise 7	TRP 2	TRP 10
4	Lower 7	CLS 2	CLS 10
5	Raise 6	TRP 3	TRP 11
6	Lower 6	CLS 3	CLS 11
7	Raise 5	TRP 4	TRP 12
8	Lower 5	CLS 4	CLS 12
9	Raise 4	TRP 5	TRP 13
10	Lower 4	CLS 5	CLS 13
11	Raise 3	TRP 6	TRP 14
12	Lower 3	CLS 6	CLS 14
13	Raise 2	TRP 7	TRP 15
14	Lower 2	CLS 7	CLS 15
15	Raise 1	TRP 8	TRP 16
16	Lower 1	CLS 8	CLS 16
17	N/C	N/C	N/C
18	N/C	Control Voltage Return	Control Voltage Return
19	N/C	Control Voltage Return	Control Voltage Return
20	N/C	Control Voltage Return	Control Voltage Return
21	N/C	Control Voltage Return	Control Voltage Return
22	N/C	Control Voltage Return	Control Voltage Return
23	N/C	Control Voltage Return	Control Voltage Return
24	N/C	Control Voltage Return	Control Voltage Return
25	N/C	Control Voltage Return	Control Voltage Return

D25K Module - Optional Control Configuration

Master Trip / Close Detection

The Digital output relays on the D25K can be wired to provide either continuity or voltage at the termination.

Terminations for the Master Trip/Close relays provide coil voltage only; and so they cannot be monitored with a continuity check.

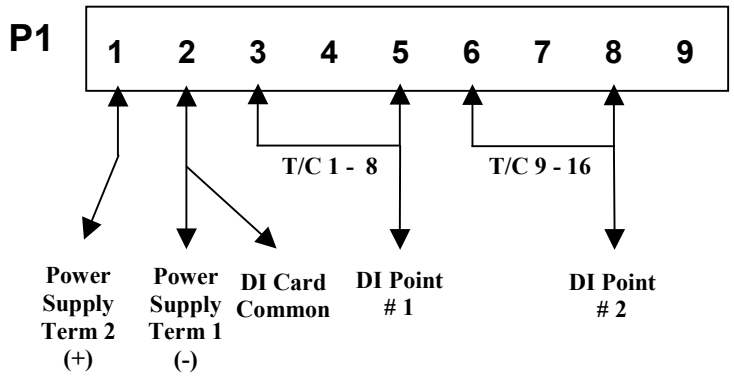
Procedure

To detect the operation of Master Trip/Close relays using digital inputs:

Step	Action
1	Jumper the Digital Input card for No Wetting (Voltage Detect) as described on page *71, Digital Input Module Configuration - Voltage Detect.*
2	Configure digital outputs for Trip/Close operation. The following connections must be made on the 9 pin compression block on the back of the D25: • connect MT to JMP1 to enable T/C for the first 8 digital outputs • connect MT to JMP2 to enable T/C for the last 8 digital outputs
3	Provide an external Control Voltage. Use the 24 or 48V supply on the back of the D25 for this.
4	Wire the negative side of the Control Voltage to the common on the Digital Input card.
5	MT and MC can now be connected to digital input points to monitor the Master Trip and Close relays.
6	Outputs of the digital outputs connectors can also be wired to digital input points to monitor individual digital outputs.

Connection Diagram

This diagram shows the connection points for the preceding procedure.



Section 2: D25K-4Z Control Module

D25K-4Z Module External Connections

Background

Note: This section discusses the configuration of the D25K-4Z control board option, *only*.

All control relays of the D25K-4Z module use 4-pole momentary contacts so that both connections to an external load, or an interposer relay, may be switched for additional control security.

Important!

The D25K-4Z module *must* be used in an enclosure that has the rear panel assembly, Part # 953-2023, installed. An enclosure fitted with the rear panel for the D25K or KE boards w*ill not* accept the D25K-4Z module.

The D25K-4Z module contains circuitry that suppress electrical transients and surges. If you connect control outputs to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The magnitude depends on the amplitude of applied voltage. The end user is responsible for the product's proper application.

Output Options

The D25K-4Z control outputs are divided into two groups of four. Each group is independently configurable as Trip/Close pairs or Digital Outputs. The following combinations are possible:

- 8 T/C pairs
- 8 Digital Outputs, or
- 4 T/C pairs and 4 Digital Outputs

T/C and DO Power Buses

Each group of four outputs has common power bus that can be connected via jumper to either:

- T/C power supply input pins, or
- Digital Output power supply input pins.

The T/C power supply is routed to the group power bus through the Master Close (MC) or the Master Trip (MT) relay. The Digital Output power supply is routed directly to the group power bus.

Output Groups

Internal to the module, the outputs are grouped as follows:

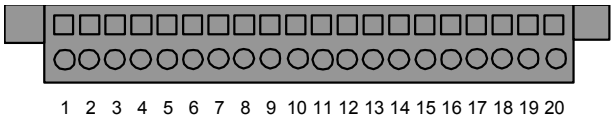
	Option	Function
Group #1	1	Trip/Close Outputs 1 – 4
	2	Digital Outputs 1 – 4
Group #2	1	Trip/Close Outputs 5 – 8
	2	Digital Outputs 5 - 8

Continued on next page

D25K-4Z Module External Connections, Continued

D25K-4Z Board Control Function Terminal Block – P1

Phoenix 20-pin terminal block – P1 Pinout:



P1 Pin	Signal	Function	Comments
1	TC-PS-P	T/C Control Voltage Input +	Power connections for Trip/Close operation
2	TC-PS-N	T/C Control Voltage Input -	
3	TC-PS-P-JP	+ Jumper connection point for fuse monitoring	Jumper to Pin 4 if only T/C *or* DO is configured
4	DO-PS-P-JP	+ Jumper connection point for fuse monitoring	Jumper to Pin 3 if only T/C *or* DO is configured
5	TC-PS-N-JP	- Jumper connection point for fuse monitoring	Jumper to Pin 6 if only T/C *or* DO is configured
6	DO-PS-N-JP	- Jumper connection point for fuse monitoring	Jumper to Pin 5 if only T/C *or* DO is configured
7	DO-PS-P	DO Control Voltage Input +	Power connections for Digital Output (or R/L) operation
8	DO-PS-N	DO Control Voltage Input -	
9	DO_PS_PAF	DO Control Voltage Input + Fused	Jumper to Pin 10 for DO outputs 1 - 4
10	T_B_RAIL_P	Group #2 T/C Common	
11	MTA_AC	MT – Contact A	Jumper to Pin 10 for T/C outputs 5 - 8
12	DO_PS_PAF	DO Control Voltage Input + Fused	Jumper to Pin 13 for DO outputs 1 - 4
13	T_A_RAIL_P	Group #1 T/C Common	
14	MTA_AC	MT – Contact A	Jumper to Pin 13 for T/C outputs 5 - 8
15	DO_PS_NAF	DO Control Voltage Input - Fused	Jumper to Pin 16 for DO outputs 5 - 8
16	T_B_RAIL_N	Group #2 T/C Common	
17	MTB_AC	MT – Contact B	Jumper to Pin 16 for T/C outputs 1 - 4
18	DO_PS_NAF	DO Control Voltage Input - Fused	Jumper to Pin 19 for DO outputs 5 - 8
19	T_A_RAIL_N	Group #1 T/C Common	
20	MTB_AC	MT – Contact B	Jumper to Pin 19 for T/C outputs 1 - 4

Continued on next page

D25K-4Z Module External Connections, Continued

External Jumper Configuration

Configuration of a D25K-4Z is done by inserting wire jumpers in the rear 20 pin compression type connector P1. In this way the D25K-4Z module can be configured without its removal from the D25.

Control Voltage Connections

Control voltage can be supplied by either:

- an external power supply, or
- the D25's power supply

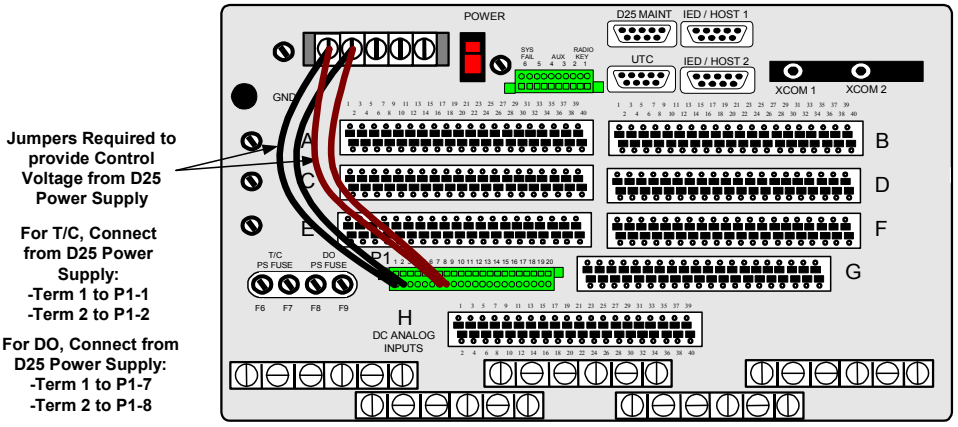
In either case, the control voltage can be connected to:

- P1 pins 1 and 2, for Trip/close, and/or
- P1 pins 7 and 8 for other output types

where it will be routed through the K-4Z board relays, the backplane connectors, and out to the external loads or interposing relays.

Power Supply Connection Diagram

The following diagram shows how the D25's internal power supply can be connected to provide control voltage to a D25K-4Z module.



D25K-4Z Module - Trip/Close Configuration

Trip/Close Configuration

Through the use of "Master" relays, the 8 digital outputs can be configured as two groups of 4 Trip/Close pairs. i.e., 16 output connections.

- The Control Voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum. See page 6 for specifications of control outputs.

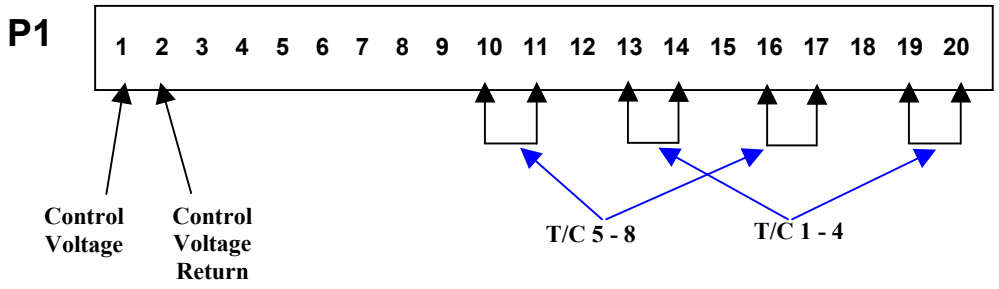
Using jumper wires on the Control Function Terminal block to configure the first group:

- connect between:
  - T_A_RAIL_P (P1-13) and MTA_AC (P1-14)
  - T_A_RAIL_N (P1-19) and MTB_AC (P1-20)

To configure the second group

- connect between:
  - T_B_RAIL_P (P1-10) and MTA_AC (P1-11)
  - T_B_RAIL_N (P1-16) and MTB_AC (P1-17)

P1 connections for Trip/Close



Schematic of Trip/Close Jumper Options

The following schematic shows an example of the flow of the Control Voltage current through the Master and Point relay contacts for the first 4 Trip/Close output pairs.

The Master Close relay is permanently connected to all point relay Close contacts. The Master Trip relay must be connected to the point relay Trip contacts by connecting the jumpers shown from P1-13 to P1-14, and P1-19 to P1-20.

The shadows show the current flow when **Trip 1** output is operating.

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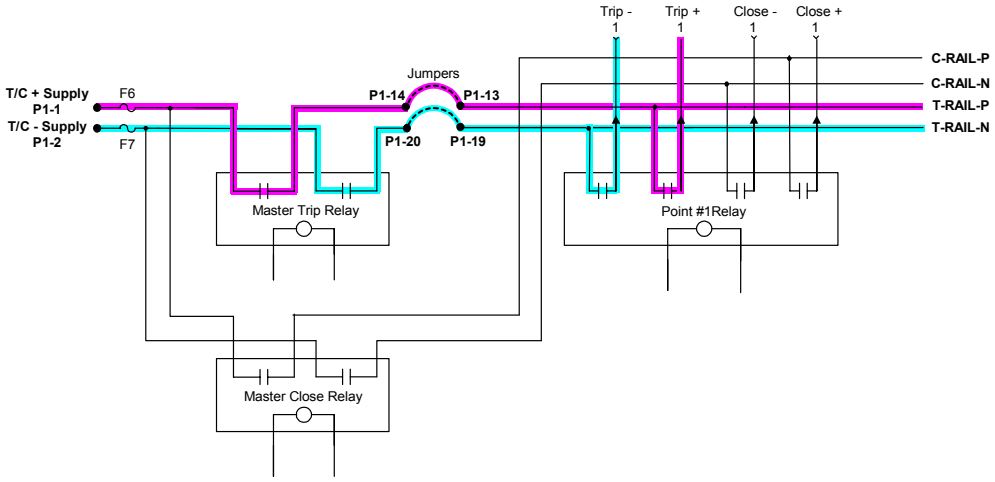
D25K-4Z Module - Trip/Close Configuration, Continued

Schematic of "Trip" Operation Control Voltage Path



Note

All types of digital outputs have a common Control Voltage + and Control Voltage – or Return.

D25K-4Z Module – Digital Output Configuration

Digital Output Configuration

Each group of 4-point relays can be configured for four digital outputs.

- The Control Voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum. See page 6 for specifications of control outputs.

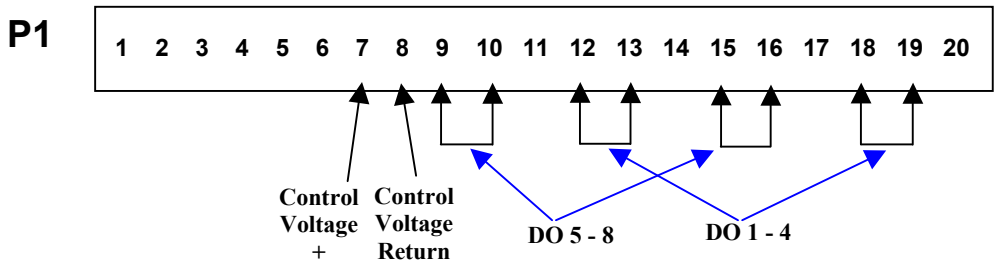
Use jumper wires on the Control Function Terminal block to configure the first group:

- connect between:
  - T_A_RAIL_P (P1-13) and DO_PS_PAF (P1-12)
  - T_A_RAIL_N (P1-19) and DO_PS_NAF (P1-18)

To configure the second group

- connect between:
  - T_B_RAIL_P (P1-10) and DO_PS_PAF (P1-9)
  - T_B_RAIL_N (P1-16) and DO_PS_NAF (P1-15)

P1 connections for Digital Output



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D25K-4Z Module – Digital Output Configuration, Continued

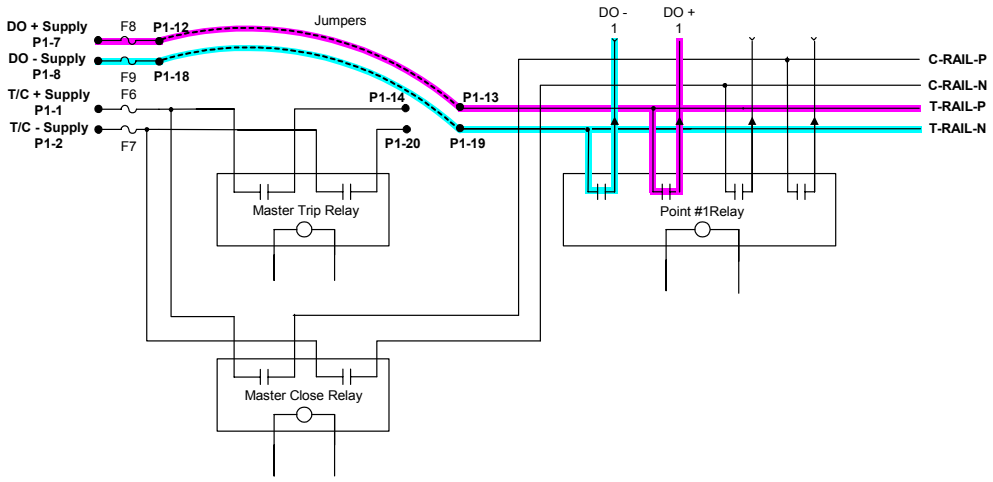
Schematic

The following schematic shows an example of the flow of the Control Voltage current through the relay contacts for the Digital Output point #1.

The Master Trip relay must be bypassed by connecting the jumpers as shown.

The shadows show the current flow when **DO 1** output is operating.

Schematic of Digital Output Operation Control Voltage Path



D25K-4Z Module - Combined T/C and DO Configuration

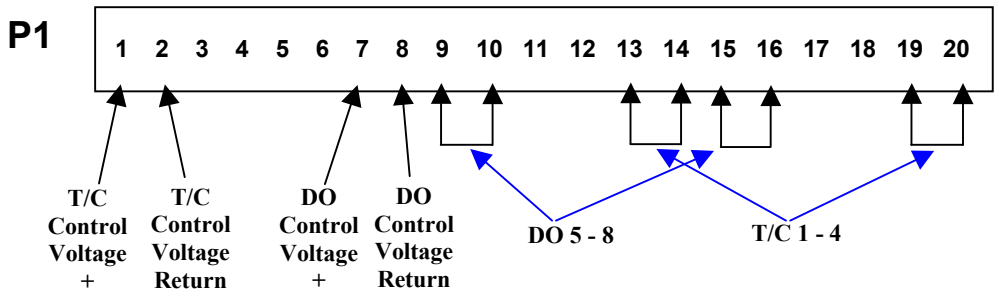
Combined Trip/Close and Digital Output Configuration

If the D25K-4Z module is to be configured with:

- the first four outputs used in a trip/close mode and
- the other four outputs used in a digital output mode

jumper the P1 connector as shown below.

P1 connections for Combined Trip/Close and Digital Output Configuration



D25K-4Z Module - Digital Output Connector

Only One Connector Option

The only digital output configuration option available:

- a 40-pin FACE-40 compression-type connector

FACE-40 Pinout: The following table shows the pinouts for D25K-4Z outputs 1 through 8.

Pin	Signal	Pin	Signal
1	TS	2	CS
3	CLS 1 +	4	TRP 1 / DO 1 +
5	CLS 1 -	6	TRP 1 / DO 1 -
7	CLS 2 +	8	TRP 2 / DO 2 +
9	CLS 2 -	10	TRP 2 / DO 2 -
11	CLS 3 +	12	TRP 3 / DO 3 +
13	CLS 3 -	14	TRP 3 / DO 3 -
15	CLS 4 +	16	TRP 4 / DO 4+
17	CLS 4 -	18	TRP 4 / DO 4 -
19	CLS 5 +	20	TRP 5 / DO 5 +
21	CLS 5 -	22	TRP 5 / DO 5 -
23	CLS 6 +	24	TRP 6 / DO 6 +
25	CLS 6 -	26	TRP 6 / DO 6 -
27	CLS 7 +	28	TRP 7 / DO 7 +
29	CLS 7 -	30	TRP 7 / DO 7 -
31	CLS 8 +	32	TRP 8 / DO 8 +
33	CLS 8 -	34	TRP 8 / DO 8 -
35	N/C	36	N/C
37	N/C	38	N/C
39	N/C	40	N/C

Note

Pins 1 and 2 of the FACE-40 connector are used for monitoring interposer relay drive current:

- TS is the monitoring point for Trip Interposer Relay drive current
- CS is the monitoring point for Close Interposer Relay drive current

D25K-4Z Fuse Monitoring

About Fuse Monitoring

As seen in the previous sections, the K-4Z module uses separate connection points for Trip/Close (T/C) and Digital Output (DO) control voltages.

If the module is used exclusively for trip/close applications, or for digital output applications, the control voltage does not need to be connected to the unused inputs.

The K-4Z module is unique in that its *Fuse Monitoring* circuitry monitors the T/C fuses separately from the DO fuses. Because the circuitry monitors the availability of control voltage *after* the fuses, a loss of control voltage for any reason, on either of the two inputs, will be interpreted as a fuse failure.

To prevent these false indications when using *only* a T/C or a DO output configuration, jumpering points have been provided on P1. Installing the jumpers as shown below will connect an "artificial" control voltage input to the unused monitoring circuit, preventing false alarm indications.

When to Install Jumpers:

If fuse monitoring is used in this D25, use the following table to decide how to jumper P1 on the D25K-4Z module.

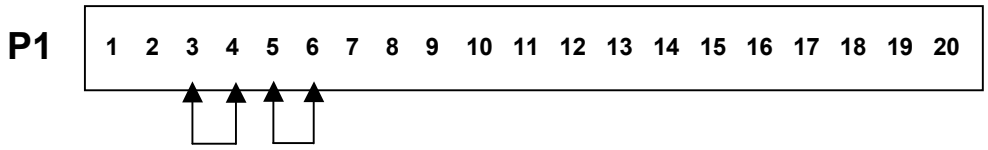
If the K-4Z module is configured for:	Then
Trip/Close operation *only*	Install jumpers
Digital Output operation *only*	Install jumpers
Both Trip/Close *and* Digital Output operation	Do not install jumpers

Jumpering for Fuse Monitoring

When configuring the D25K-4Z module for trip/close or digital output *only*:

- jumper P1-3 to P1-4, and
- jumper P1-5 to P1-6

as shown below.



Caution

Do Not install these jumpers when the K-4Z module is configured for *both* trip/close and digital output, when using separate power supplies for each output type.

Doing so will defeat some of the functionality of the fuse monitoring system, and may cause damage to the K-4Z module or attached equipment.

Section 3: D25KE Control Module

D25KE Module External Connections

Background

Note: This section discusses the configuration of the D25KE control board options, *only*.

The D25KE Control Module contains (up to) 32 digital output relays, either:

- divided into (up to) 4 groups of 8 relays
  - each group is separately configurable as trip/close (T/C) pairs, or raise/lower (R/L) pairs via field selectable jumpers
- divided into (1 or) 2 groups of 8 pairs of relays
  - again, each group is separately configurable as T/C or R/L

Two Variations, Ten Options of D25KE

The D25KE control modules are available in two variations:

- one with 6 DB-25 connectors for field wiring and one 8-pin compression terminal block for optioning
- the other with up to 2 FACE-40 connectors for field wiring and optioning

Important!

Each variant of D25KE *must* be used in a D25 enclosure with the correct rear panel.

The D25KE module contains circuitry that suppress electrical transients and surges. If control outputs are connected to AC power source or AC load, the electrical properties and physical connection of the varistors and capacitors result in the appearance of voltage on adjacent outputs. The magnitude depends on the amplitude of applied voltage. The end user is responsible for the proper application of this product.

These Modules….			Must Use This Rear Panel
DB-25	32 chan	517-0447	Part # 953-1012
"	24 chan	517-0453	"
"	16 chan	517-0449	"
"	8 chan	517-0448	"
FACE-40	32 chan	517-0443	Part # 953-1011
"	24 chan	517-0450	"
"	16 chan	517-0452	(same, only 1 FACE-40 connector)
"	8 chan	517-0451	"

Continued on next page

D25KE Module External Connections, Continued

Important!

- An enclosure fitted with the rear panel for either the D25K or D25K-4Z boards *will not* physically accept the D25KE module.
- The D25KE module can be used *only* with a D25 using the WESDAC Type III DAC board.
  - If the D25KE Control Module is connected to WESDAC Type II DAC board, the watchdog circuitry of the KE board will generate an alarm, and disable operation of the module.

About KE Rear Panels

All DB-25 D25KE modules are installed in a D25 enclosure that has six DB-25 connectors on the backplane, regardless of how many channels the KE board has.

i.e., a 24, 16 or 8 channel DB-25 KE module will have one or more DB-25 connectors that will not be used.

A KE module installed in an enclosure with FACE-40 connectors will *only* have the connectors necessary to support the number of channels in use.

i.e., 32 and 24 channel KE modules will have two FACE-40 connectors, 16 and 8 channel modules will have only one FACE-40 connector installed.

Output Options

The 32 D25KE digital outputs are divided into up to four groups of eight relays.

- Each of the four groups are independently configurable as Trip/Close pairs or Raise/Lower Digital Outputs.

External Jumper Configuration

- The configuration of the D25KE DB-25 module is done by inserting wire jumpers in the rear 8-pin compression type connector P1.

Note: You can use GE Energy Services quad-wire jumper, part # 970-0264, or make an equivalent jumper, as desired.

- The configuration of the D25KE FACE-40 module is done by jumpering pins of the two FACE-40 connectors G1 and G2.

In this way, either variant of D25KE module can be configured without its removal from the D25 enclosure.

D25KE DB-25 Module - Digital Output Connections

D25KE DB-25 Connector Pinouts J1 to J3

The following table shows the DB-25 connector pinouts for D25KE outputs 1 through 16.

Note: TRPx = Trip output point x

CLSx = Close output point x

J1 DB-25 Pin	Signal	J2 DB-25 Pin	Signal	J3 DB-25 Pin	Signal
1	TRP1	1	TRP9	1	TRP1
2	CLS1	2	CLS9	2	TRP2
3	TRP2	3	TRP10	3	TRP3
4	CLS2	4	CLS10	4	TRP4
5	TRP3	5	TRP11	5	TRP5
6	CLS3	6	CLS11	6	TRP6
7	TRP4	7	TRP12	7	TRP7
8	CLS4	8	CLS12	8	TRP8
9	TRP5	9	TRP13	9	TRP9
10	CLS5	10	CLS13	10	TRP10
11	TRP6	11	TRP14	11	TRP11
12	CLS6	12	CLS14	12	TRP12
13	TRP7	13	TRP15	13	TRP13
14	CLS7	14	CLS15	14	TRP14
15	TRP8	15	TRP16	15	TRP15
16	CLS8	16	CLS16	16	TRP16
17	NC	17	NC	17-25	NC
18-25	COIL_SUP_ RTN	18-25	COIL_SUP_ RTN		

Continued on next page

D25KE DB-25 Module - Digital Output Connections, Continued

D25KE DB-25 Connector Pinouts J4 to J6

The following table shows the DB-25 connector pinouts for D25KE outputs 17 through 32.

J4 DB-25 Pin	Signal	J5 DB-25 Pin	Signal	J6 DB-25 Pin	Signal
1	TRP17	1	TRP25	1	TRP17
2	CLS17	2	CLS25	2	TRP18
3	TRP18	3	TRP26	3	TRP19
4	CLS18	4	CLS26	4	TRP20
5	TRP19	5	TRP27	5	TRP21
6	CLS19	6	CLS27	6	TRP22
7	TRP20	7	TRP28	7	TRP23
8	CLS20	8	CLS28	8	TRP24
9	TRP21	9	TRP29	9	TRP25
10	CLS21	10	CLS29	10	TRP26
11	TRP22	11	TRP30	11	TRP27
12	CLS22	12	CLS30	12	TRP28
13	TRP23	13	TRP31	13	TRP29
14	CLS23	14	CLS31	14	TRP30
15	TRP24	15	TRP32	15	TRP31
16	CLS24	16	CLS32	16	TRP32
17	NC	17	NC	17-25	NC
18-25	COIL_SUP_ RTN	18-25	COIL_SUP_ RTN		

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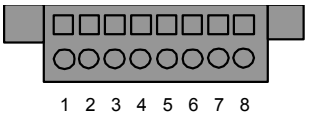
D25KE DB-25 Module - Digital Output Connections, Continued

D25KE DB-25 Control Function Terminal Block – P1

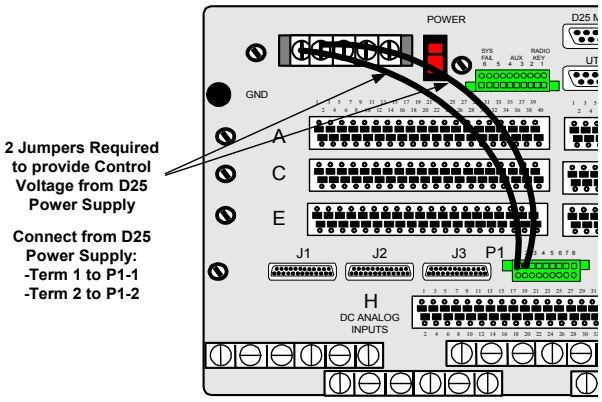
Phoenix 8-pin terminal block – P1 Pinout:



P1 Pin	Signal	Function	Comments
1	COIL_SUP	Control Voltage	Interposer Relay Coil Power Supply connections
2	COIL_SUP_ RTN	Control Voltage return	
3	JMP1	Relays 1-8 mode jumper point	Jumper to Pin 1-5 (+VC) for R/L Jumper to Pin 1-6 (MT) for T/C
4	JMP2	Relays 9-16 mode jumper point	Jumper to Pin 1-5 (+VC) for R/L Jumper to Pin 1-6 (MT) for T/C
5	+VC	Control Voltage (fused)	Jumper to JMP1 through 4 for R/L
6	MT	Master Trip Bus	Jumper to JMP1 through 4 for T/C
7	JMP3	Relays 17-24 mode jumper point	Jumper to Pin 1-5 (+VC) for R/L Jumper to Pin 1-6 (MT) for T/C
8	JMP4	Relays 25-32 mode jumper point	Jumper to Pin 1-5 (+VC) for R/L Jumper to Pin 1-6 (MT) for T/C

Control Voltage Connections

Control voltage can be supplied by either an external power supply, or the D25's own power supply. In either case, the control voltage will be connected to P1 pins 1 and 2. The following diagram shows how the D25's internal power supply can be connected to provide control voltage.



Note: The (external) control voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum.

D25KE DB-25 Trip/Close Configuration

Background

Through the use of "Master" relays, the 32 digital outputs can be configured as four groups of eight Trip/Close pairs. i.e., 64 output connections.

Note: The Control Voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum. See page 6 for specifications of control outputs.

P1 connections for Trip/Close

Use jumper wires on the Control Function Terminal block P1 to configure the first group:

- connect between MT (P1-6) and JMP1 (P1-3)

To configure group 2:

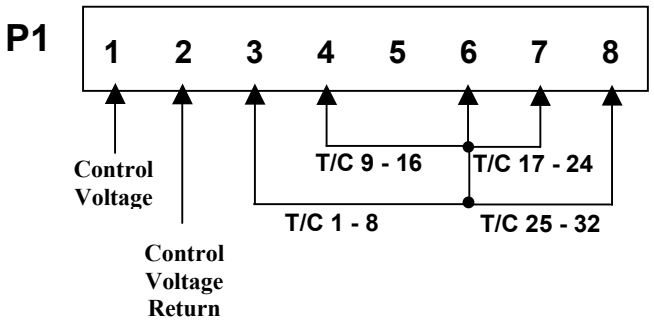
- connect between MT (P1-6) and JMP2 (P1-4)

To configure group 3:

- connect between MT (P1-6) and JMP3 (P1-7)

To configure group 4:

- connect between MT (P1-6) and JMP4 (P1-8)



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D25KE DB-25 Trip/Close Configuration, Continued

About the DB-25 Option

The D25KE DB-25 connector option is designed for use primarily with WESTERM D20 KI interposing relay panels, part # 517-0166, and 517-0167.

For this connection use a multi conductor shielded DB-25 cable assembly.

Note

Ensure that the multi-conductor cable's shield drain wire is connected to pin 17 of the WESTERM D20 KI DB-25 connector.

Pin 17 of the D25KE's DB-25 connector is not connected internally, and therefore, cannot be used as a drain connection.

Note

For Trip/Close operation, the cables used to connect the D25 control outputs to the D20 KI panels must have all DB-25 pins connected end-to-end.

- Use GE Energy Services part number 977-0208, or equivalent.

Trip/Close Connections to Interposing Relay Panels

The D25KE module requires four WESTERM KI interposing relay panels to support 32 pairs of Trip/Close digital outputs.

Note: For all KI relay panels, one of the Z1 jumpers must be installed to provide a return path for the control voltage. KI panels, part # 517-0166 and 517-0167 will have these jumpers installed.

For the first group of eight digital outputs:

- Connect a DB-25 cable from J1 of the D25KE to J2 of the first WESTERM KI interposing relay panel.

For the second group of eight digital outputs:

- Connect a DB-25 cable from J2 of the D25KE to J2 of the second WESTERM KI interposing relay panel.

For the third group of eight digital outputs:

- Connect a DB-25 cable from J4 of the D25KE to J2 of the third WESTERM KI interposing relay panel.

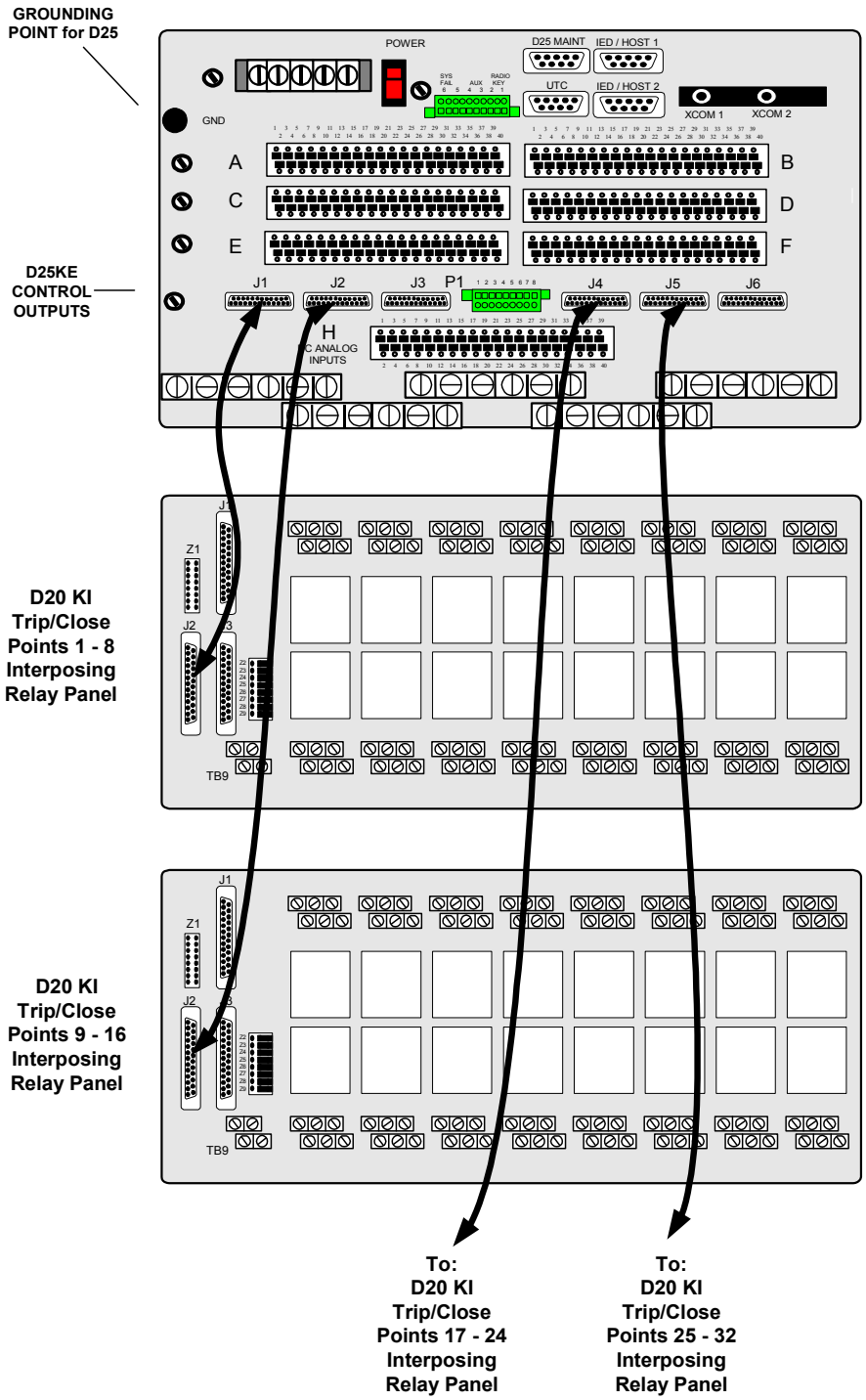
For the fourth group of eight digital outputs:

- Connect a DB-25 cable from J5 of the D25KE to J2 of the fourth WESTERM KI interposing relay panel.

D25KE DB-25 Module – Trip/Close Connection Diagrams

D25KE Trip/Close Connection Diagram

The diagram below illustrates the connections used when configuring a D25KE module for Trip/Close operation using up to four-D20 KI interposing relay panels.



D25KE DB-25 Raise/Lower Configuration

Background

The 32 digital outputs can be configured as four groups of four Raise/Lower pairs.

Note: The (external) control voltage can be up to 75 Vdc or 50 Vac, at 2 Amps maximum.

P1 connections for Raise/Lower

Use jumper wires on the Control Function Terminal block to configure the first group:

- connect between +VC (P1-5) and JMP1 (P1-3)

To configure group 2:

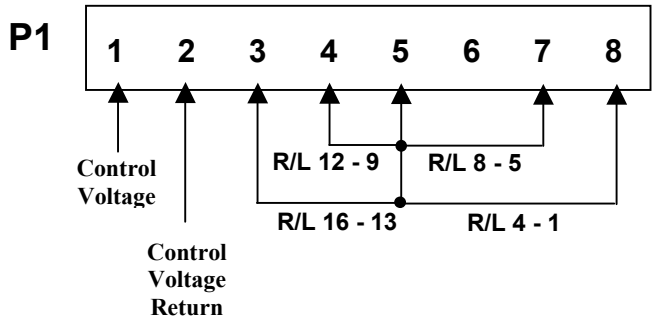
- connect between +VC (P1-5) and JMP2 (P1-4)

To configure group 3:

- connect between +VC (P1-5) and JMP3 (P1-7)

To configure group 4:

- connect between +VC (P1-5) and JMP4 (P1-8)



Note

Raise/Lower Digital Outputs are numbered in the reverse order. i.e., Lower point #1 is Digital Output point #32

Raise/Lower Connections to Interposing Relay Panels

The D25KE module requires two WESTERM KI interposing relay panels to support 16 pairs of Raise/Lower digital outputs. To configure and connect the digital outputs:

- Connect a DB-25 cable from J3 of the D25KE to J1 of the first WESTERM KI interposing relay panel.
- Connect another DB-25 cable from J6 of the D25KE to J1 of the second WESTERM KI interposing relay panel.
- Connect a Control Voltage Return connection from the D25KE's P1-2 to each of the D20 KI's TB9-1
- Set both WESTERM KI's Jumpers Z2 – 9 to 2 - 3

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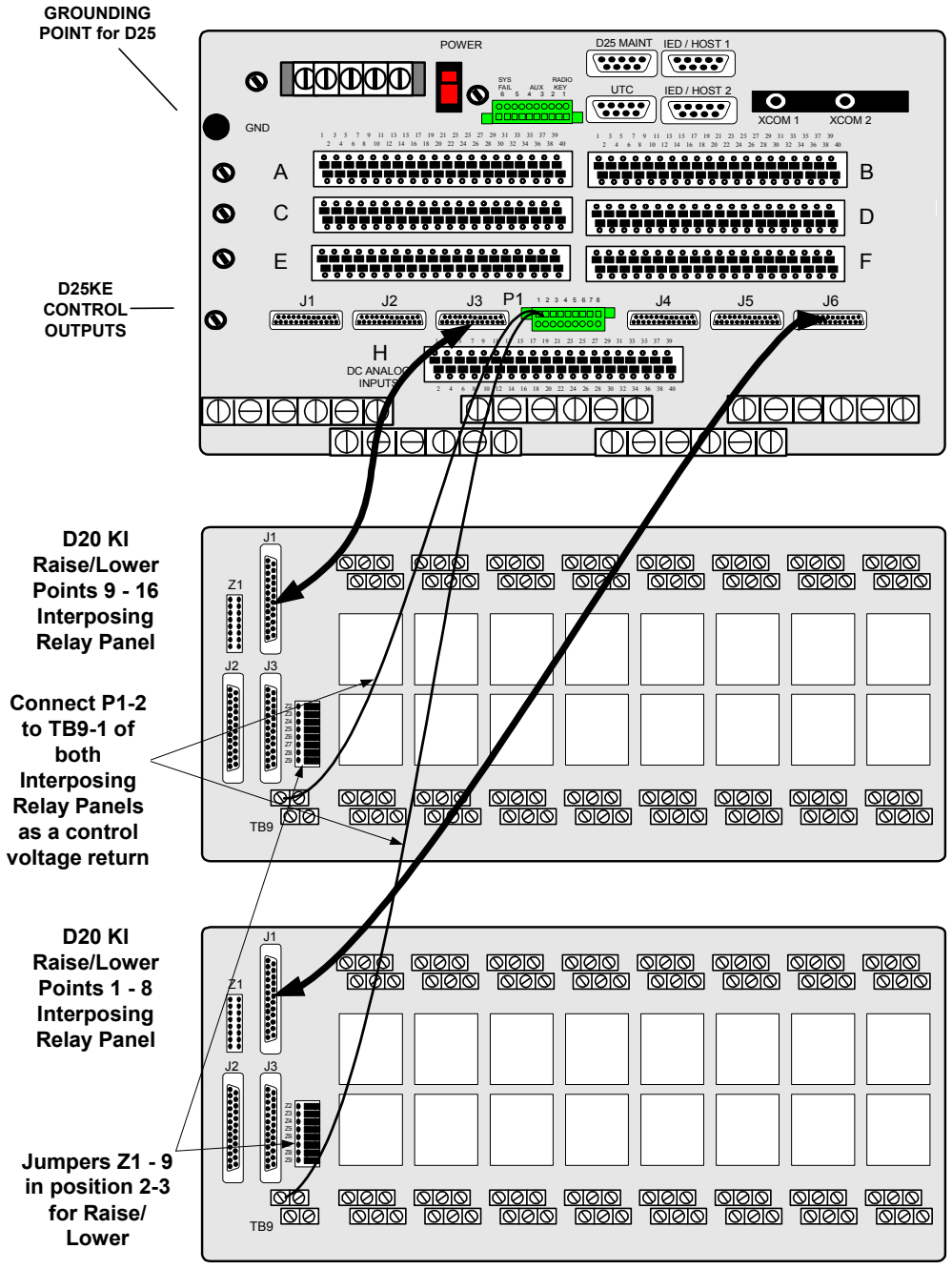
D25KE DB-25 Raise/Lower Configuration, Continued

Raise/Lower Connection Diagram

The diagram below illustrates the connections used when configuring for Raise/Lower operation using two D20 KI interposing relay panels.



D25KE DB-25 Combined R/L and T/C

Background

Trip/Close and Raise/Lower digital outputs can be used on the same D25KE DB-25 module.

Note

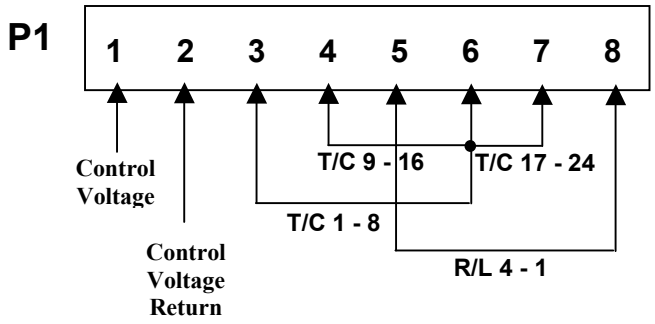
The three examples shown below are the *only* recommended configuration options for combining trip/close and raise/lower in one D25KE.

Do Not configure raise/lower points with point numbers lower than the trip/close point numbers as it may result in wiring problems, and interposing relay connection problems.

Combined T/C and R/L #1

In the following example, the first 24 digital outputs are configured as trip/close, and the last 8 are configured as 4 raise/lower pairs.

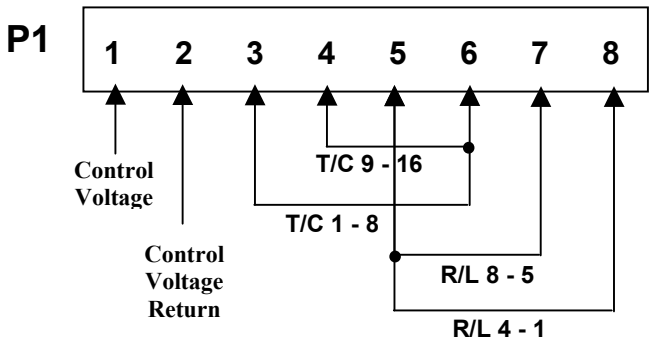
P1 connections for Combined Raise/Lower and Trip/Close



Combined T/C and R/L #2

This example shows the P1 jumpers when the first 16 digital outputs are configured as trip/close, and the second 16 outputs are configured as 8 raise/lower pairs.

P1 connections for Combined Trip/Close and Raise/Lower



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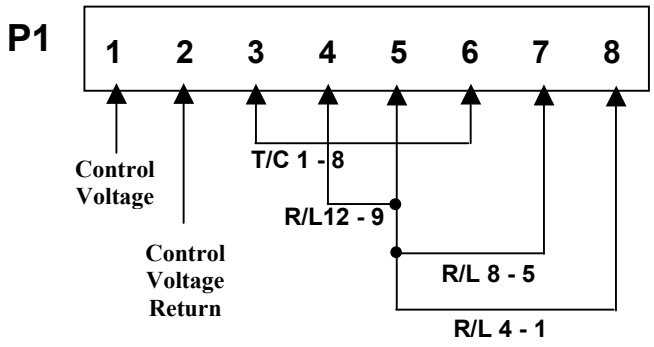
D25KE DB-25 Combined R/L and T/C, Continued

Combined T/C and R/L #3

This example shows the P1 jumpers when the first 8 digital outputs are configured as trip/close, and the second 24 outputs are configured as 12 raise/lower pairs.

P1 connections for Combined Trip/Close and Raise/Lower



D25KE FACE-40 Module - Digital Output Connections

Connector G1 Pinouts

The following table shows the pinouts for FACE-40 connector G1, outputs 1 to 16.

G1 Pin	Signal	G1 Pin	Signal	G1 Pin	Signal
1	COIL_SUP	15	CLS7	29	CLS14
2	COIL_RTN	16	TRP7	30	TRP14
3	CLS1	17	CLS8	31	CLS15
4	TRP1	18	TRP8	32	TRP15
5	CLS2	19	CLS9	33	CLS16
6	TRP2	20	TRP9	34	TRP16
7	CLS3	21	CLS10	35	VCA
8	TRP3	22	TRP10	36	VCA
9	CLS4	23	CLS11	37	JMP1
10	TRP4	24	TRP11	38	JMP2
11	CLS5	25	CLS12	39	MTA
12	TRP5	26	TRP12	40	MTA
13	CLS6	27	CLS13		
14	TRP6	28	TRP13		

Connector G2 Pinouts

The following table shows the pinouts for FACE-40 connector G2 outputs 17 to 32.

G2 Pin	Signal	G2 Pin	Signal	G2 Pin	Signal
1	VCB	15	CLS20	29	CLS27
2	VCB	16	TRP20	30	TRP27
3	JMP3	17	CLS21	31	CLS28
4	JMP4	18	TRP21	32	TRP28
5	MTB	19	CLS22	33	CLS29
6	MTB	20	CLS22	34	TRP29
7	MCA	21	CLS23	35	CLS30
8	MCB	22	TRP23	36	TRP30
9	CLS17	23	CLS24	37	CLS31
10	TRP17	24	TRP24	38	TRP31
11	CLS18	25	CLS25	39	CLS32
12	TRP18	26	TRP25	40	TRP32
13	CLS19	27	CLS26		
14	TRP19	28	TRP26		

Continued on next page

D25KE FACE-40 Module - Digital Output Connections, Continued

D25KE FACE-40 Board Control Optioning

Specific pins of both FACE-40 connectors, G1 and G2, are used to configure the D25KE module for trip/close or raise/lower operation. Those pins are listed below:

Pin	Signal	Function	Comments
G1 1	COIL_SUP	Control Voltage input	Control Voltage Power Supply connections
G1-2	COIL_SUP_RTN	Control Voltage return	
Control Option Jumpers – Points 1 to 16			
G1-35	VCA	R/L Control Voltage for O/P 1-8 (fused)	
G1-36	VCA	R/L Control Voltage for O/P 9-16 (fused)	
G1-37	JMP1	O/P Relays 1-8 mode jumper point	Jumper to Pin G1-35 (VCA) for Raise/Lower Jumper to Pin G1-39 (MTA) for T/C operation
G1-38	JMP2	O/P Relays 9-16 mode jumper point	Jumper to Pin G1-36 (VCA) for Raise/Lower Jumper to Pin G1-40 (MTA) for T/C operation
G1-39	MTA	Trip Bus For Channels 1 to 8	
G1-40	MTA	Trip Bus For Channels 9 to 16	
Control Option Jumpers – Points 17 to 32			
G2-1	VCB	R/L Control Voltage for O/P 17 to 24 (fused)	
G2-2	VCB	R/L Control Voltage for O/P 25 to 32 (fused)	
G2-3	JMP3	O/P Relays 17-24 mode jumper point	Jumper to Pin G2-1 (VCB) for Raise/Lower Jumper to Pin G2-5 (MTB) for T/C operation
G2-4	JMP4	O/P Relays 25-32 mode jumper point	Jumper to Pin G2-2 (VCB) for Raise/Lower Jumper to Pin G2-6 (MTB) for T/C operation
G2-5	MTB	Trip Bus For Channels 17 to 24	
G2-6	MTB	Trip Bus For Channels 25 to 32	
Master Close Relay Monitoring Points			
G2-7	MCA	Master Close Bus for Channels 1 to 16	*Do not* connect to load or power supply. Use only for monitoring.
G2-8	MCB	Master Close Bus for Channels 17 to 32	*Do not* connect to load or power supply. Use only for monitoring.

Continued on next page

D25KE FACE-40 Module - Digital Output Connections, Continued

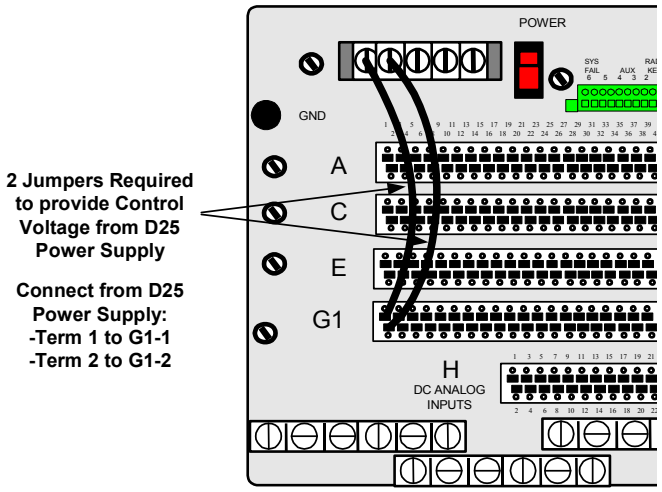
Control Voltage Connections

Control voltage can be supplied by either an external power supply, or the D25's own power supply

In either case, the control voltage will be connected to G1 pins 1 and 2

Note: The (external) control voltage can be up to 120 Vdc at 2 Amps (maximum). See page 6 for specifications of control outputs.

The following diagram shows how the D25's internal power supply can be connected to provide control voltage.



D25KE FACE-40 Module Trip/Close Configuration

Background

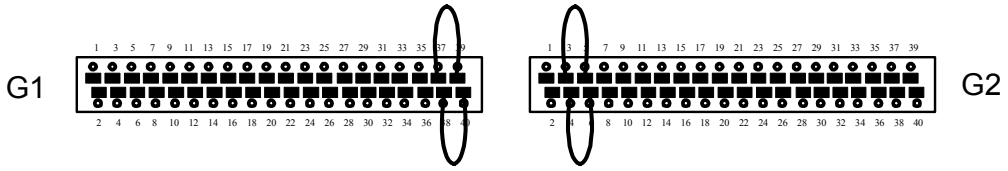
Through the use of "Master" relays, the 32 digital outputs can be configured as four groups of eight Trip/Close pairs. i.e., 64 output connections.

Note: The control voltage can be up to 120 Vdc at 2 Amps maximum. See page 6 for specifications of control outputs.

G1 and G2 connections for Trip/Close

Use jumper wires on the FACE-40 terminal block G1 to configure groups 1 and 2.

- To configure group 1:
  - connect between MTA (G1-39) and JMP1 (G1-37)
- To configure group 2:
  - connect between MTA (G1-40) and JMP2 (G1-38)



Use jumper wires on the FACE-40 terminal block G2 to configure groups 3 and 4.

- To configure group 3:
  - connect between MTB (G2-5) and JMP3 (G2-3)
- To configure group 4:
  - connect between MTB (G2-6) and JMP4 (G2-4)

D25KE FACE-40 Module Raise/Lower Configuration

Background

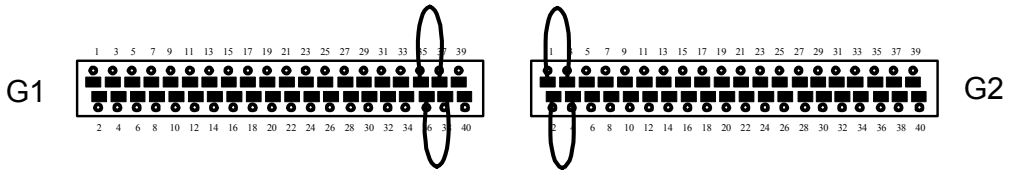
The 32 digital outputs can be configured as four groups of four Raise/Lower pairs.

Note: The control voltage can be up to 120 Vdc at 2 Amps maximum. See page 6 for specifications of control outputs.

G1 and G2 connections for Raise/Lower

Use jumper wires on the FACE-40 terminal block G1 to configure groups 1 and 2.

- To configure group 1:
  - connect between VCA (G1-35) and JMP1 (G1-37)
- To configure group 2:
  - connect between VCA (G1-36) and JMP2 (G1-38)



Use jumper wires on the FACE-40 terminal block G2 to configure groups 3 and 4.

- To configure group 3:
  - connect between VCB (G2-1) and JMP3 (G2-3)
- To configure group 4:
  - connect between VCB (G2-2) and JMP4 (G2-4)

D25KE FACE-40 Combined R/L and T/C

Background

Trip/Close and Raise/Lower digital outputs can be used on the same D25KE FACE-40 unit.

When assigning raise/lower groups, always start with group 4, then group 3, and lastly group 2.

Remember that raise/lower points number in the reverse direction from other point types. i.e., point 32 will become lower point 1.

Note

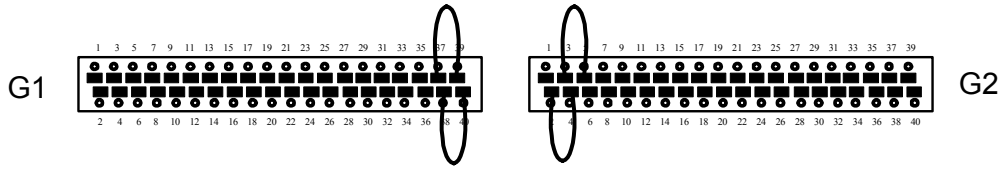
Configuring raise/lower groups with numbers lower than the trip/close group numbers, or between trip/close groups can result in a very complex and confusing wiring scheme.

G1 and G2 Connections for: 3 Groups of Trip/Close, and One Group of Raise/Lower

The following example illustrates the jumpering required to configure a D25KE FACE-40 module for 3 groups of trip/close, and one group of raise/lower.

Use jumper wires on the FACE-40 terminal block G1 to configure groups 1 and 2.

- To configure group 1:
  - connect between MTA (G1-39) and JMP1 (G1-37)
- To configure group 2:
  - connect between MTA (G1-40) and JMP2 (G1-38)



Use jumper wires on the FACE-40 terminal block G2 to configure groups 3 and 4.

- To configure group 3 for trip/close:
  - connect between MTB (G2-5) and JMP3 (G2-3)
- To configure group 4 for raise/lower:
  - connect between VCB (G2-2) and JMP4 (G2-4)

Continued on next page

D25KE FACE-40 Combined R/L and T/C, Continued

D25KE Configuration Summary Table

Product	Configuration		Jumper position			
			Relays 1-8	Relays 9-16	Relays 17-24	Relays 25-32
	T/C	R/L	JMP1	JMP2	JMP3	JMP4
517-0443 D25KE Control Module FACE40 32 Channel	32	0	G1/37-G1/39	G1/38-G1/40	G2/3-G2/5	G2/4-G2/6
	24	4	G1/37-G1/39	G1/38-G1/40	G2/3-G2/5	G2/2-G2/4
	16	8	G1/37-G1/39	G1/38-G1/40	G2/1-G2/3	G2/2-G2/4
	8	12	G1/37-G1/39	G1/36-G1/38	G2/1-G2/3	G2/2-G2/4
	0	16	G1/35-G1/37	G1/36-G1/38	G2/1-G2/3	G2/2-G2/4
517-0451 D25KE Control Module FACE40 8 Channel	8	0	G1/37-G1/39	N/A	N/A	N/A
	0	4	G1/35-G1/37	N/A	N/A	N/A
517-0452 D25KE Control Module FACE40 16 Channel	16	0	G1/37-G1/39	G1/38-G1/40	N/A	N/A
	8	4	G1/37-G1/39	G1/36-G1/38	N/A	N/A
	0	8	G1/35-G1/37	G1/36-G1/38	N/A	N/A
517-0453 D25KE Control Module FACE40 24 Channel	24	0	G1/37-G1/39	G1/38-G1/40	G2/3-G2/5	N/A
	16	4	G1/37-G1/39	G1/38-G1/40	G2/1-G2/3	N/A
	8	8	G1/37-G1/39	G1/36-G1/38	G2/1-G2/3	N/A
	0	12	G1/35-G1/37	G1/36-G1/38	G2/1-G2/3	N/A
517-0454 D25KE Control Module FACE40 2x8 Channel	2x8	0	G1/37-G1/39	N/A	G2/3-G2/5	N/A
	0	2x4	G1/35-G1/37	N/A	G2/1-G2/3	N/A
517-0455 D25KE Control Module FACE40 2x16 Channel	2x16	0	G1/37-G1/39	G1/38-G1/40	G2/3-G2/5	G2/4-G2/6
	2x8	2x4	G1/37-G1/39	G1/36-G1/38	G2/3-G2/5	G2/2-G2/4
	0	2x8	G1/35-G1/37	G1/36-G1/38	G2/1-G2/3	G2/2-G2/4
517-0447 D25KE Control Module DB25 32 Channel	32	0	P1/3-P1/6	P1/4-P1/6	P1/6-P1/7	P1/6-P1/8
	24	4	P1/3-P1/6	P1/4-P1/6	P1/6-P1/7	P1/5-P1/8
	16	8	P1/3-P1/6	P1/4-P1/6	P1/5-P1/7	P1/5-P1/8
	8	12	P1/3-P1/6	P1/4-P1/5	P1/5-P1/7	P1/5-P1/8
	0	16	P1/3-P1/5	P1/4-P1/5	P1/5-P1/7	P1/5-P1/8
517-0448 D25KE Control Module DB25 8 Channel	8	0	P1/3-P1/6	N/A	N/A	N/A
	0	4	P1/3-P1/5	N/A	N/A	N/A

Continued on next page

D25KE FACE-40 Combined R/L and T/C, Continued

D25KE Configuration Summary Table, continued

Product	Configuration		Jumper position			
			Relays 1-8	Relays 9-16	Relays 17-24	Relays 25-32
	T/C	R/L	JMP1	JMP2	JMP3	JMP4
517-0449 D25KE Control Module DB25 16 Channel	16	0	P1/3-P1/6	P1/4-P1/6	N/A	N/A
	8	4	P1/3-P1/6	P1/4-P1/5	N/A	N/A
	0	8	P1/3-P1/5	P1/4-P1/5	N/A	N/A
517-0450 D25KE Control Module DB25 24 Channel	24	0	P1/3-P1/6	P1/4-P1/6	P1/6-P1/7	N/A
	16	4	P1/3-P1/6	P1/4-P1/6	P1/5-P1/7	N/A
	8	8	P1/3-P1/6	P1/4-P1/5	P1/5-P1/7	N/A
	0	12	P1/3-P1/5	P1/4-P1/5	P1/5-P1/7	N/A

Note: Use GE product 970-0264 Quad-Wire Jumper or plain wire of appropriate gauge to configure D25KE card.

D25KE Fuse Monitoring

About Fuse Monitoring

D25KE control modules include circuitry that detects the presence of control voltage *after* it has passed through their fuses.

Software in the D25 Plant I/O Subsystem, P097 V2.30 or greater, responds to the signal from the KE module and creates a pseudo digital input that can be seen in the D25's System Point Database.

If a fuse opens, or the control voltage is removed from the output module for any reason, the pseudo DI for that module will change state, providing an alarm.

If the control module is not installed, or removed, the pseudo DI point will remain in the *Off* state.

Note 1: The fuse monitoring circuitry can only detect a control voltage above approximately 12 Vdc. If the control voltage is less than this level, the fuse monitoring circuitry will not sense any voltage, and the pseudo DI point will remain in the *Off* state.

Note 2: Fuse monitoring works with (+)ve or (-)ve grounded systems.

Note 3: For D25s with Plant I/O Version 2.30, the fuse-monitoring feature will only work with DC control voltages. Versions greater than 2.30 *only* support AC control voltage monitoring for the D25KE control module.

Section 4: D25KE-4Z Control Module

About Paired Relay Controls

Background

The D25KE–4Z Control modules incorporate a feature where two output relays operate simultaneously for each control request.

For example, when a request to operate a trip on point 1 is received by the module, it will automatically operate relay 1 and relay 17 (n + 16) at the same time. Each of these relay pairs is referred to as a channel.

In this way, both supply and return connections to a load can be switched, totally isolating the load from the D25 when the contacts are open.

Two Variants

The part numbers of the two variants of the D25KE–4Z modules are:

- 517-0454
  - a 16-relay card providing 8 pairs, or channels of outputs
- 517-0455
  - a 32-relay card providing 2 groups of 8 paired outputs, or 16 channels

D25KE–4Z Module Digital Output Connections

Connector G1 Pinouts

The following table shows the supply pinouts for D25KE–4Z module FACE-40 connector G1 outputs 1A through 16A.

G1 Pin	Signal	G1 Pin	Signal	G1 Pin	Signal
1	COIL_SUP	15	CLS7-A	29	CLS14-A
2	COIL_RTN	16	TRP7-A	30	TRP14-A
3	CLS1-A	17	CLS8-A	31	CLS15-A
4	TRP1-A	18	TRP8-A	32	TRP15-A
5	CLS2-A	19	CLS9-A	33	CLS16-A
6	TRP2-A	20	TRP9-A	34	TRP16-A
7	CLS3-A	21	CLS10-A	35	VCA
8	TRP3-A	22	TRP10-A	36	VCA
9	CLS4-A	23	CLS11-A	37	JMP1
10	TRP4-A	24	TRP11-A	38	JMP2
11	CLS5-A	25	CLS12-A	39	MTA
12	TRP5-A	26	TRP12-A	40	MTA
13	CLS6-A	27	CLS13-A		
14	TRP6-A	28	TRP13-A		

Connector G2 Pinouts

The following table shows the return pinouts for D25KE–4Z module FACE-40 connector G2 outputs 1B through 16B.

G2 Pin	Signal	G2 Pin	Signal	G2 Pin	Signal
1	VCB	15	CLS4-B	29	CLS11-B
2	VCB	16	TRP4-B	30	TRP11-B
3	JMP3	17	CLS5-B	31	CLS12-B
4	JMP4	18	TRP5-B	32	TRP12-B
5	MTB	19	CLS6-B	33	CLS13-B
6	MTB	20	TRP6-B	34	TRP13-B
7	MCA	21	CLS7-B	35	CLS14-B
8	MCB	22	TRP7-B	36	TRP14-B
9	CLS1-B	23	CLS8-B	37	CLS15-B
10	TRP1-B	24	TRP8-B	38	TRP15-B
11	CLS2-B	25	CLS9-B	39	CLS16-B
12	TRP2-B	26	TRP9-B	40	TRP16-B
13	CLS3-B	27	CLS10-B		
14	TRP3-B	28	TRP10-B		

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D25KE–4Z Module Digital Output Connections, Continued

D25KE–4Z FACE-40 Board Control Optioning

Specific pins of both FACE-40 connectors, G1 and G2, are used to configure the D25KE–4Z module for trip/close or raise/lower operation. Those pins are listed below:

Pin	Signal	Function	Comments
G1 1	COIL_SUP	Control Voltage input	Control Voltage Power Supply connections
G1-2	COIL_SUP_RTN	Control Voltage return	
Control Option Jumpers – Points 1A to 16A			
G1-35	VCA	R/L Control Voltage for O/P 1A-8A (fused)	
G1-36	VCA	R/L Control Voltage for O/P 9B-16B (fused)	
G1-37	JMP1	O/P Relays 1A-8A mode jumper point	Jumper to Pin G1-35 (VCA) for Raise/Lower Jumper to Pin G1-39 (MTA) for Trip/Close
G1-38	JMP2	O/P Relays 9A-16A mode jumper point	Jumper to Pin G1-36 (VCA) for Raise/Lower Jumper to Pin G1-40 (MTA) for Trip/Close
G1-39	MTA	Trip Bus For Channels 1A to 8A	
G1-40	MTA	Trip Bus For Channels 9A to 16A	
Control Option Jumpers – Points 1B to 16B			
G2-1	VCB	R/L Control Voltage for O/P 1B to 8B (fused)	
G2-2	VCB	R/L Control Voltage for O/P 9B to 16B (fused)	
G2-3	JMP3	O/P Relays 1B-8B mode jumper point	Jumper to Pin G2-1 (VCB) for Raise/Lower Jumper to Pin G2-5 (MTB) for Trip/Close
G2-4	JMP4	O/P Relays 9B-16B mode jumper point	Jumper to Pin G2-2 (VCB) for Raise/Lower Jumper to Pin G2-6 (MTB) for Trip/Close
G2-5	MTB	Trip Bus For Channels 1B to 8B	
G2-6	MTB	Trip Bus For Channels 9B to 16B	
Master Close Relay Monitoring Points			
G2-7	MCA	Master Close Bus for Channels 1A to 16A	*Do not* connect to load or power supply. Use only for monitoring.
G2-8	MCB	Master Close Bus for Channels 1B to 16B	*Do not* connect to load or power supply. Use only for monitoring.

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D25KE–4Z Module Digital Output Connections, Continued

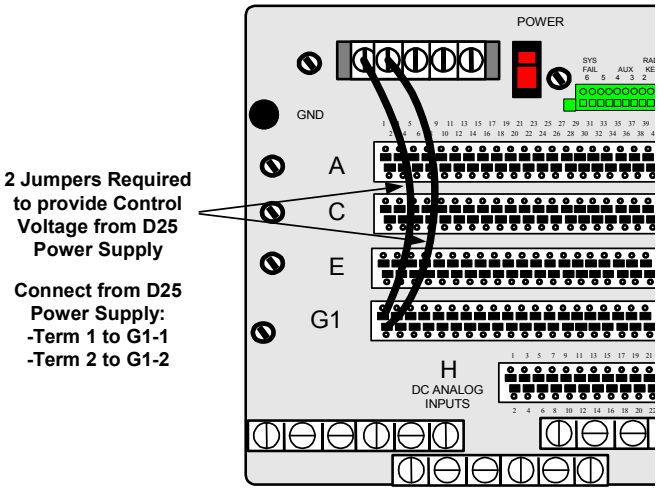
Control Voltage Connections

Control voltage can be supplied by either an external power supply, or the D25's own power supply.

In either case, the control voltage will be connected to G1 pins 1 and 2.

Note: The (external) control voltage can be up to 120 Vdc at 2 Amps maximum.

The following diagram shows how the D25's internal power supply can be connected to provide control voltage.



D25KE–4Z Module Trip/Close Configuration

Background

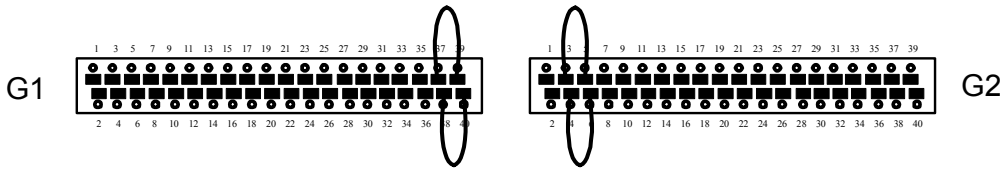
Through the use of "Master" relays, the 16 digital outputs can be configured as two groups of eight Trip/Close pairs. i.e., 32 paired output connections.

Note: The control voltage can be up to 120 Vdc at 2 Amps maximum. See page 6 for specifications of control outputs.

G1 and G2 connections for Trip/Close

Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 1.

- To configure group 1:
  - connect between MTA (G1-39) and JMP1 (G1-37), and
  - connect between MTB (G2-5) and JMP3 (G2-3)



Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 2.

- To configure group 2:
  - connect between MTA (G1-40) and JMP2 (G1-38), and
  - connect between MTB (G2-6) and JMP4 (G2-4)

D25KE–4Z Module Raise/Lower Configuration

Background

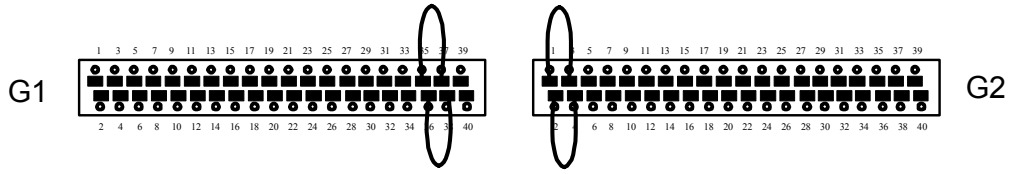
The 16 digital outputs can be configured as two groups of four Raise/Lower pairs.

Note: The control voltage can be up to 120 Vdc at 2 Amps maximum. See page 6 for specifications of control outputs.

G1 and G2 connections for Raise/Lower

Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 1.

- To configure group 1:
  - connect between VCA (G1-35) and JMP1 (G1-37), and
  - connect between VCB (G2-1) and JMP3 (G2-3)



Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 2.

- To configure group 2:
  - connect between VCA (G1-36) and JMP2 (G1-38), and
  - connect between VCB (G2-2) and JMP4 (G2-4)

D25KE–4Z Module Combined R/L and T/C

Background

Trip/Close and Raise/Lower digital outputs can be used on the same D25KE–4Z module.

When combining a raise/lower group with a trip/close group, always use group 2 for raise/lower.

Remember that raise/lower points number in the reverse direction from other point types. i.e., point 16 will become lower point 1.

Note

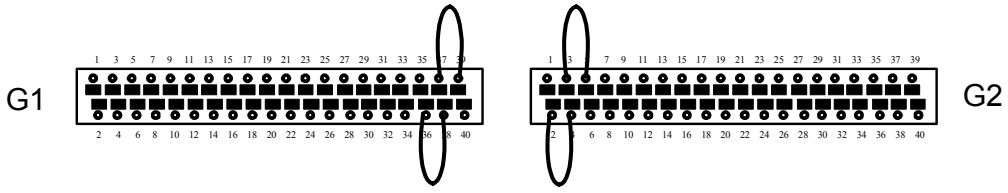
*C*onfiguring a raise/lower group as group 1 may result in a very complex and confusing wiring scheme.

G1 and G2 Connections for: One Group of Trip/Close, and One Group of Raise/Lower

The following example illustrates the jumpering required to configure a D25KE–4Z module for one group of trip/close, and one group of raise/lower.

Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 1 for trip/close.

- To configure group 1:
  - connect between MTA (G1-39) and JMP1 (G1-37), and
  - connect between MTB (G2-5) and JMP3 (G2-3)



Use jumper wires on the FACE-40 terminal blocks G1 and G2 to configure group 2 for raise/lower.

- To configure group 2:
  - connect between VCA (G1-36) and JMP2 (G1-38), and
  - connect between VCB (G2-2) and JMP4 (G2-4)

Chapter 7: DC Analog Configurations

About DC Analog Options

DC Analog Inputs

- All DC Analog Card options are available with either 8 or 16 inputs.
- The inputs may be either voltage or current.
- With the exception of the 517-0416 and 0417 cards that use adapter modules, there are no on-board option jumpers; i.e., each option requires a different card.
- All inputs should have shield connected at source of signal. Shields can alternately be connected to the auxiliary ground on D25 power supply terminal block. *DO NOT* ground at both ends of cable.

Refer to: Chapter 3: for available options.

Choosing the Right Module

In order to select or verify that you have the optimal module for your application, this information may be useful:

- In the System Point Database, the measured analog values are represented by digital counts that have a 15-bit plus sign resolution, providing a maximum range of +32767 to –32768.
- Unscaled (100% scaling) analog values cannot exceed the range of +32767 to –32768, and will be limited to these counts when analog inputs exceed nominal values.
- Increasing scaling factors (in Config Pro configuration tables) decreases the range and resolution of displayed digital counts.

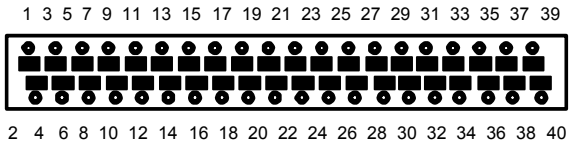
The table below shows the typical digital counts stored in the D25's System Point Database representing inputs at several input levels, and scaling settings, for each DC Analog board option.

		10%	25%	50%	75%	Nom	120%
Input Option	+/- 5V	.5V	1.25V	2.5V	3.75V	5V	6V
	+/- 1 mA	.1 mA	.25 mA	.5 mA	.75 mA	1 mA	1.2 mA
	+/- 5 mA	.5 mA	1.25 mA	2.5 mA	3.75 mA	5 mA	6 mA
	+/- 10 mA	1 mA	2.5 mA	5 mA	7.5 mA	10 mA	12 mA
	+/- 20 mA	2 mA	4 mA	10 mA	15 mA	20 mA	24 mA
Displayed Digital Count	@ 83.333% Scaling	2731	6826	13653	20479	27306	32767
	@ 100% Scaling	3277	8192	16383	24575	32767	>32767
	@ 200% Scaling	6553	16383	32767	>32767	>32767	>32767

Continued on next page

About DC Analog Options, Continued

DC Analog Input Connector Pinout:



This table also shows the location of adapters on the module's PCB for each input

Pin	SIGNAL	Pin	SIGNAL	Input Adapter Location
1	Ain 1+	2	Ain 1-	M1
3	Ain 2+	4	Ain 2-	M2
5	Ain 3+	6	Ain 3-	M3
7	Ain 4+	8	Ain 4-	M4
9	Ain 5+	10	Ain 5-	M5
11	Ain 6+	12	Ain 6-	M6
13	Ain 7+	14	Ain 7-	M7
15	Ain 8+	16	Ain 8-	M8
17	N/C	18	N/C	
19	N/C	20	N/C	
21	N/C	22	N/C	
23	N/C	24	N/C	
25	Ain 9+	26	Ain 9-	M9
27	Ain 10+	28	Ain 10-	M10
29	Ain 11+	30	Ain 11-	M11
31	Ain 12+	32	Ain 12-	M12
33	Ain 13+	34	Ain 13-	M13
35	Ain 14+	36	Ain 14-	M14
37	Ain 15+	38	Ain 15-	M15
39	Ain 16+	40	Ain 16-	M16

Chapter 8: AC Analog Configurations

Overview & Contents

Introduction

This Chapter illustrates the field wiring points for all generations of D25. To help the installer understand the connection techniques, background information about how the D25 is configured is included.

In This Chapter

This Chapter contains the following Topics:

AC Analog Configurations, Gen. 1 & 2

Input Transformers

The Gen. 1 & 2 D25 can accept up to 15 analog inputs, which are grouped into five sets of three each.

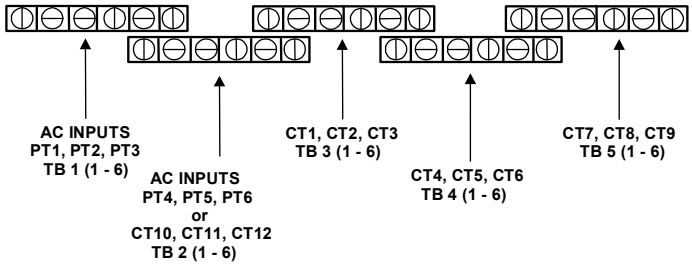
Transformers can be either

- Current Transformers (CT) or
- Voltage (Potential) Transformers (PT)

If no AC inputs are specified, AC Input configuration is disabled.

Gen. 1 & 2 AC Analog Input Connections

This graphic and the tables below show the possible input termination options for Gen. 1 and Gen. 2 Plant I/O.



Note: When TB2 is used as a current (CT) input, the inputs are CT10 through CT12.

TB 1	Signal
1	PT1A
2	PT1B
3	PT2A
4	PT2B
5	PT3A
6	PT3B

TB 3	Signal
1	CT1A
2	CT1B
3	CT2A
4	CT2B
5	CT3A
6	CT3B

TB 5	Signal
1	CT7A
2	CT7B
3	CT8A
4	CT8B
5	CT9A
6	CT9B

TB 2	Signal
1	PT4A/CT10A
2	PT4B/CT10B
3	PT5A/CT11A
4	PT5B/CT11B
5	PT6A/CT12A
6	PT6B/CT12B

TB 4	Signal
1	CT4A
2	CT4B
3	CT5A
4	CT5B
5	CT6A
6	CT6B

AC Analog Configurations, Gen. 3 & 4

Input Transformers

As in previous generations, the D25 can have up to 15 AC analog inputs, which are grouped into five sets of three each.

Gen. 3 D25s can be ordered with virtually any combination of CTs and PTs.

The only restrictions are:

- TB1 inputs *must* be PTs
- Each group of 3 transformers *must* be of the same type

If no AC inputs are specified, AC Input configuration is disabled.

Disabled parameters appear in dark green in the Config Pro I/O Configuration window

Flexible PT/CT Arrangements

As mentioned above, all AC input groups can be populated with either PTs or CTs with the exception of the first AC input group that can *only* be populated with PTs.

The table below summarizes the new arrangement possibilities and the associated PT/CT numbering.

AC Input	PT Arrangement	CT Arrangement
1	PT1	N/A
2	PT2	N/A
3	PT3	N/A
4	PT4	CT10
5	PT5	CT11
6	PT6	CT12
7	PT7	CT1
8	PT8	CT2
9	PT9	CT3
10	PT10	CT4
11	PT11	CT5
12	PT12	CT6
13	PT13	CT7
14	PT14	CT8
15	PT15	CT9

AC Analog Mapping and Connections

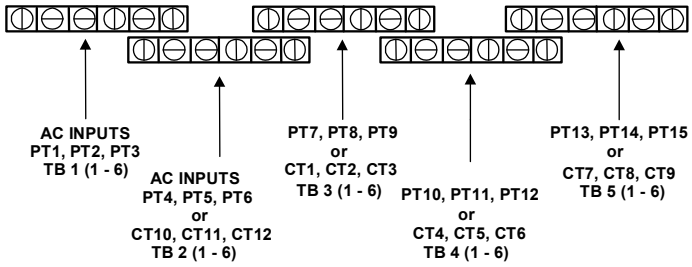
Gen. 3 AC Circuit Options

For Gen. 3 D25s, a flexible AC input mapping feature, called **E-Z Map,** is included that allows you to configure, for each input of an AC circuit, the physical AC input that supplies the required signal.

This feature gives you complete flexibility in wiring the AC inputs and assigning them to the appropriate circuit inputs.

Note: E-Z Map can *only* be used to configure Gen. 3 D25s, *not* Gen. 1 or 2.

AC Analog Physical Input Connections



TB 1	Signal
1	PT1A
2	PT1B
3	PT2A
4	PT2B
5	PT3A
6	PT3B

TB 3	Signal
1	PT7A/CT1A
2	PT7B/CT1B
3	PT8A/CT2A
4	PT8B/CT2B
5	PT9A/CT3A
6	PT9B/CT3B

TB 5	Signal
1	PT13A/CT7A
2	PT13B/CT7B
3	PT14A/CT8A
4	PT14B/CT8B
5	PT15A/CT9A
6	PT15B/CT9B

TB 2	Signal
1	PT4A/CT10A
2	PT4B/CT10B
3	PT5A/CT11A
4	PT5B/CT11B
5	PT6A/CT12A
6	PT6B/CT12B

TB 4	Signal
1	PT10A/CT4A
2	PT10B/CT4B
3	PT11A/CT5A
4	PT11B/CT5B
5	PT12A/CT6A
6	PT12B/CT6B

Caution!

Use extreme caution when connecting field wiring to the AC inputs.

The Gen. 3 D25s can be ordered with a wide variety of input options, and there are no obvious indications on the rear of the D25 enclosure to identify the type of inputs installed.

Connecting a CT to a voltage input (or vice versa) may cause equipment damage and/or severe injury

Chapter 9: Communications

Overview & Contents

Introduction

The two Parts of this Chapter outlines the connection techniques and methods used for each of the serial and LAN interface options of your D25.

The first part covers connections to the standard communication interfaces of a D25, and the second details the connection to the optional XCOM interfaces.

Included are interface cable schematics for the various serial interface options.

In This Chapter

This Chapter contains the following Sections and Topics

Section 1: Standard Serial Interfaces

Connecting Serial Interfaces

COM0 - WESMAINT II+ Port

The WESMAINT II+ DB-9-F connector on the front panel is a standard feature of the D25.

By attaching the 9-pin female jack of a WESMAINT II+ cable to the D25, and the other end of the WESMAINT II+ cable to a PC, the D25 can:

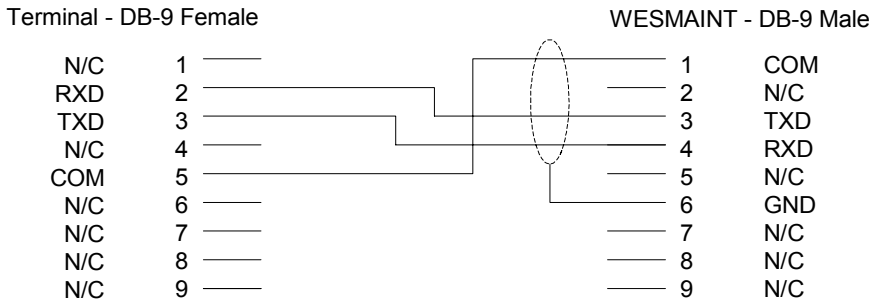
- provide local maintenance and diagnostic functionality;
- download configuration data from the optional Config Pro software;
- upload diagnostic and operational information from the D25

WESMAINT II+ supports RS-232 signaling, and operates at a fixed rate of 9600 bps.

Serial WESMAINT Cable

To connect to a PC, use a WESMAINT II+ cable (GE Energy Services Part # 977-0048/96), or equivalent.

The schematic for this cable is shown below.



COM1

D25 MAINT Display Port

The DB-9-F D25 MAINT display interface option is designed to provide a local port for optional display devices.

This port provides:

- fixed communication parameters
- RS-485 interface
- interface is 2-wire or 4-wire, selected using Config Pro
  - a 2-wire cable is required for 2-wire operation, see cable schematic below.

Continued on next page

Connecting Serial Interfaces, Continued

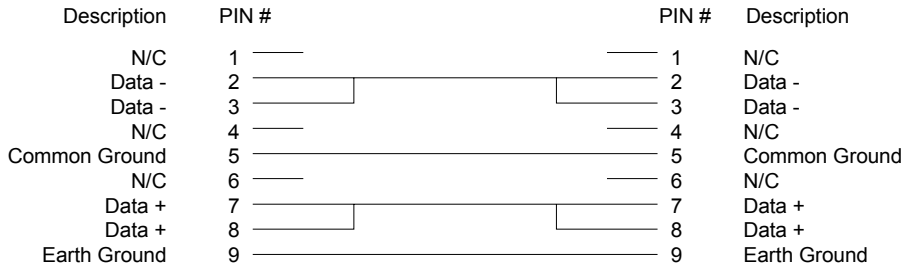
D25 MAINT Port Pinout

The following table shows the pinout of the D25 MAINT DB-9 connector.

DB-9 Pin	RS-485
1	N/C
2	RX-
3	TX-
4	N/C
5	Com GND
6	N/C
7	TX+
8	RX+
9	EARTH GND

2-Wire RS-485 Cable

The following schematic shows the cable wiring necessary for 2-Wire RS-485 connection.



COM2

Universal Time Code (UTC) Port

- Used to interface a satellite time-code receiver, or equivalent.
- The DB-9-F UTC port can be selected for *receive-only* RS-232 or RS-422 interface, using Config Pro.
- Supported UTC Port protocols are IRIG-B and Rugby
- Communication parameters are determined by the protocol application.

Note

Many IRIG-B receivers are available with modulated and/or unmodulated output options.

- The input to the UTC port must be unmodulated.
- If the unmodulated output of the receiver is a coaxial connection, a converter will be required to interface the D25.

Continued on next page

Connecting Serial Interfaces, Continued

UTC Port Pinout

The following table shows how to connect to the UTC Port DB-9 connector for either RS-232 or RS-422 interface.

Note: Pins 7 and 8 are tied together internally.

DB-9 Pin	RS-422 Signal	RS-232 Signal
1	T_RX+	N/C
2	T_RX-	RX
3	N/C	N/C
4	N/C	N/C
5	COM GND	COM GND
6	CLKE+	N/C
7	CLKE-	N/C
8	N/C	CTS
9	EARTH GND	EARTH GND

COM3 and COM4

Two on-board general-purpose communication ports are available on the back panel of the D25, and use female DB-9-F style connectors.

IED1 and IED2 Serial Ports

Both RS-232 and RS-485 (for multi-drop applications) are supported on the same physical connector.

The IED ports provide

- Variable communication parameters
- Optional software flow control
- Optional hardware flow control
- Out-of-sequence transmission of one byte of data
- Support for several I/O timers
- Transmission of break characters

Serial Ports Options

The COM3 and COM4 serial ports are programmed via Config Pro for:

- RS-232 or RS-485 selection
- RS-485 2-Wire / 4-Wire selection

Note: The 2 to 4-Wire selection in Config Pro's **Device Properties** *only* affects the internal software control (handshaking) of the interface.

It *does not* change the physical characteristics of the communication ports.

Continued on next page

Connecting Serial Interfaces, Continued

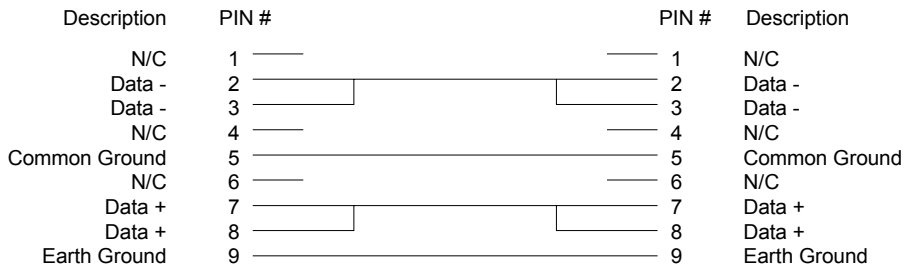
Serial Port Pinouts

The pinouts for COM3 and COM4 serial ports for both RS-232 to RS-485 configurations are:

DB-9 Pin	RS-232	RS-485
1	CD	N/C
2	RX	RX-
3	TX	TX-
4	N/C	N/C
5	GND	Com GND
6	N/C	N/C
7	RTS	TX+
8	CTS	RX+
9	EARTH GND	EARTH GND

2-Wire RS-485 Cable

The following schematic shows the cable wiring necessary for 2-Wire RS-485 operation.



Configuring RS-485 2-Wire

Background

In RS-485 two-wire mode, the transmitter is controlled by the RTS line internal to the D25 (i.e. the RTS signal is not propagated on to the serial cable, but is present inside the hardware).

While RTS is active, the transceiver is in transmit mode. The “preamble” and “postamble” timers determine the delay prior to transmission, and the amount of time following transmission that the transmitter remains in control of the RS-485 line.

When the RTS line drops, the RS-485 port is placed back in receive mode until the next time the D25 requests a transmission.

There is a third timer used to configure the amount of time the receiver must be idle before the transmitter can be engaged. Although this timer is configurable, most software applications do not have this timer in their configurations, and thus it is left at its default value.

The Issue

Prior to version 2.35 of the D25 Base software, the D25 used a default value of 50 milliseconds for all these timers when in RS-485 mode.

In some cases, this 50 ms time was too long for reliable communication with other RS-485 devices. This problem cannot be resolved when the application communicating through the RS-485 port is not configurable.

If you experience this problem, you may be able to upgrade the Base software in your D25. As of version 2.35 and on, the default timers have been reduced to 1 millisecond, possibly resolving the problems.

Section 2: Optional XCOM Communication Cards

Connecting Serial XCOM Interfaces

Background

An Ethernet or a Serial XCOM external communication module can be factory installed in the D25, or added as an upgrade at a later time.

Regardless of which option is chosen, the two XCOM interfaces are designated COM5 and COM6, respectively:

Serial XCOM

The 580-0991, and special order 580-0933, cards have two DB-9-F interfaces, labeled XCOM1 and XCOM2.

They both have these characteristics:

- External power connection
- Programmed via Config Pro for:
  - RS-232 or RS-485
  - RS-485 2-Wire or 4-Wire

Note: The 2 to 4-Wire selection in Config Pro's Device Properties *only* affects the internal software control (handshaking) of the interface. It *does not* change the physical characteristics of the ports.

XCOM Serial Port Pinouts:

The pinouts for COM5 and COM6 serial ports for both RS-232 and RS-485 configurations are:

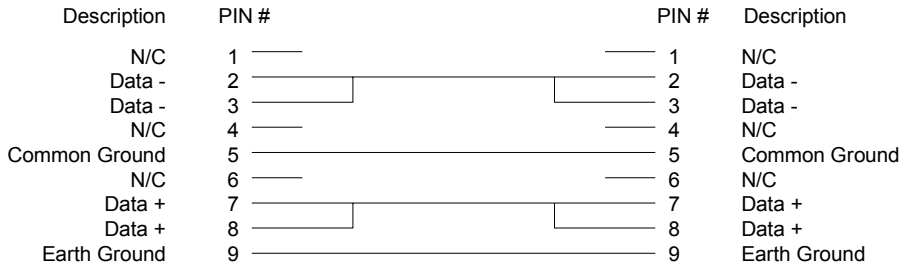
DB-9 Pin	RS-232	RS-485
1	CD	N/C
2	RX	RX-
3	TX	TX-
4	(+12V)	(+12V)
5	GND	Com GND
6	(-12V)	(-12V)
7	RTS	TX+
8	CTS	RX+
9	EARTH GND	EARTH GND

Continued on next page

Connecting Serial XCOM Interfaces, Continued

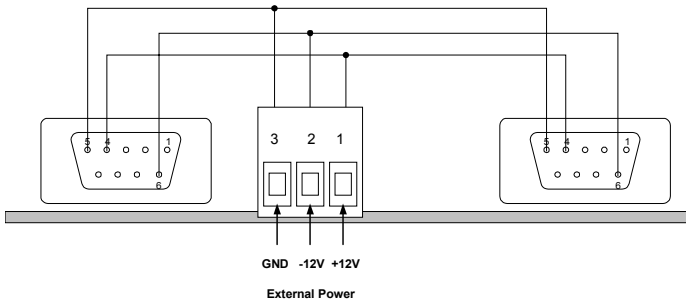
2-Wire RS-485 Cable

The following schematic shows the cable wiring necessary for 2-Wire RS-485 operation.



External ±12 Volt Supply

The 580-0931 card is equipped with a 3-pin terminal (Phoenix) block, where the power for modems attached to the DB-9 connectors can be externally supplied.



Note

While the power connections are labeled ±12 Volts, they can be used to provide a variety of AC or DC voltages.

Use care not to exceed connector or cable specifications.

Caution

580-0933 Special Order Only

The 580-0933 type of serial XCOM is available *only* through special order.

This modified card provides power for external communication devices, such as modems, from the D25's internal power supply. This violates the isolation specifications of the card, and can lead to two problems, if not accounted for:

- an external surge of voltage, such as a lightning strike, can be passed from a modem into the D25's internal circuitry where damage may occur
- inadvertent connection of power to the card's external 3-pin terminal block may cause damage to the D25's power system

Differences Between IED and Serial XCOM Ports

Choosing Which Ports to Use.

The XCOM ports are designed to provide the same functionality as the IED Ports, with this difference:

The XCOM ports run at a lower priority than the IED ports. It is therefore most efficient to put the heaviest communication on the XCOM ports.

Explanation

If you place the heaviest traffic on the IED ports, servicing of the XCOM ports will often be delayed by the higher priority IED ports.

Testing has shown that constant high-volume traffic on the IED ports can cause the XCOM ports to lose data. By placing the lower traffic connections on the IED ports, you ensure that they will always get serviced in a timely manner. The higher traffic on the XCOM ports will be interrupted only momentarily (and within the buffering ability of the XCOM card) by small bursts on the higher priority IED ports.

Connecting Ethernet XCOM Interfaces

Ethernet / 802.3

Three variations of Ethernet / 802.3 XCOM cards are available.

- 10BASE2
- 10BASE-T
- 10BASE-FL

All have dual interfaces, labeled XCOM1 and XCOM2, as a standard feature.

Refer to: Page 48, *XCOM Cards - Ethernet* for information about jumper options.

10BASE2 Card Connections & Indicators

- Cable: "Thin" Coax RG-58
- Connection is BNC-type.
- First and last units on coaxial cable need 50Ω termination

Note: The 10BASE2 XCOM card has no LED indicators on its back panel.

10BASE-T Card Connections & Indicators

- Unshielded Twisted-Pair (UTP) wire
- RJ-type connectors used
- Either a point-to-point or star network topology using multi-port repeater, or Hub.

The 10BASE-T module has six LEDs on its back panel.

LED	Function	Comments
RCV	Transceiver is receiving	• should turn on when connection is made, indicating receiver is unsquelched. • blinks when traffic is received
XMT	Transceiver is transmitting	flashes only when transmitting
JAB	Network Jabber status	• normally off • transmitter will be disabled when on
CLS	Collision is taking place on network	indicates a JAM signal is being broadcast on LAN
POL	Receive Polarity	off when receive polarity is correct
LTF	Link Test Fail	• low signal level received. • both the transmitter and receiver are disabled

Continued on next page

Connecting Ethernet XCOM Interfaces, Continued

10BASE-FL Card Connections & Indicators

- Fiber-optic media
- ST-type connectors.

The 10BASE-FL module has six LEDs on its back panel.

LED	Function	Comments
RCV	Transceiver is receiving	blinks when traffic is received
XMT	Transceiver is transmitting	flashes only when transmitting
PWR	Power is applied	normally on
JAB	Network Jabber status	when on, transmitter is disabled
CLS	Collision is taking place on network	indicates a JAM signal is being broadcast on LAN
LMO	Link Monitor	indicates low light level received

Part III: Servicing the D25

Overview & Contents

Introduction

This Part of the guide describes how to maintain the D25, including topics and procedures describing:

- locations and standard values of all fuses
- how to disassemble and reassemble the unit
- how to set option jumpers on various modules
- upgrade and replacement of modules
- a field-replacement of an entire D25 unit
- installing and replacing configuration and code files into the D25's memory
- the use of WESMAINT and the 68K Monitor in testing and verifying the operation of the D25.

Low Maintenance

All of GE Energy Services products are designed to not require any scheduled maintenance routines.

Periodic inspection, however, is suggested to ensure that:

- Unit has sustained no accidental physical damage
- Airflow is not obstructed
- Connectors and cables are intact and firmly attached

In This Part

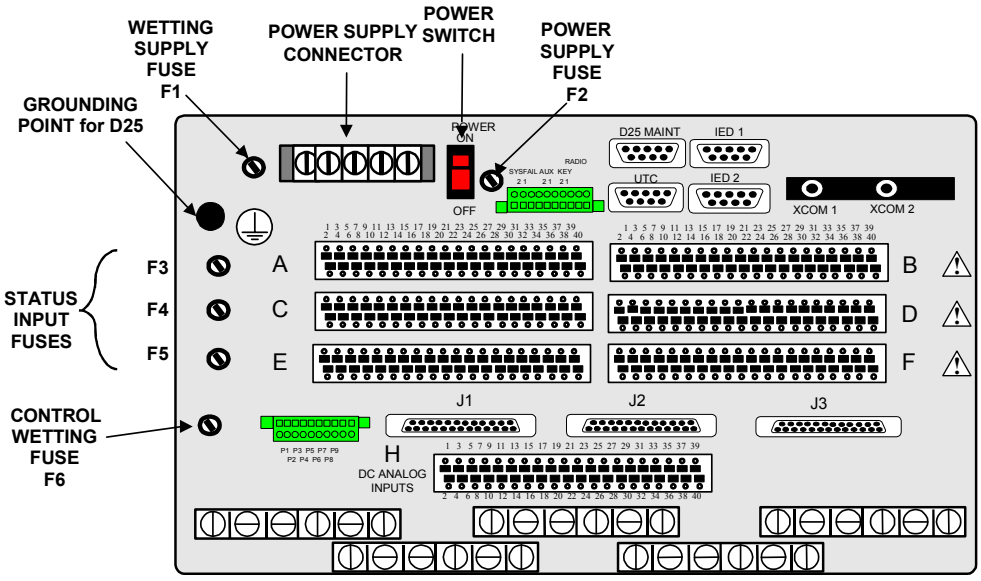
This Part contains the following Chapters and Sections:

Chapter 10: Externally Accessible Fuses

Fuse Replacement

Fuse Locations

In addition to the main power supply fuses, all Digital Input and Digital output modules are equipped with field replaceable fuses. The fuse locations for a typical D25 with 3 S-boards and a DB-25 terminated K-board are shown below.



Note: A diagram showing the fuses used by the K-4Z control module can be seen on Page 95.

Note

The fuses listed in the following table are the *standard* (at the time of printing of this document) fuses that will be factory installed, unless otherwise specified.

Fuse ratings may change due to:

- unique customer-specific configurations or requirements, or
- product specification changes

When changing fuses, *always* check original fuse for value and type, and that replacement fuse is of that value and type, i.e., do not assume that installed fuse is of the correct value.

Continued on next page

Fuse Replacement, Continued

Replaceable Fuses

The following table shows the *standard* replaceable fuses that are used by the various hardware options.

Fuse	Board Type	Rating	Where Used	Fuse Part #
F1	521-0124	AGC 0.75A 250V	24V Field Supply	940-0010
	521-0118	AGC 0.75A 250V	24V Field Supply	940-0010
	521-0119	AGC 0.75A 250V	48V Field Supply	940-0010
	521-0135	AGC 1.0A 250V	24V Field Supply	940-0021
	521-0136	AGC 1.0A 250V	24V Field Supply	940-0021
	521-0138	MDL 0.5A 250V	48V Field Supply	940-0215
	521-0139	MDL 0.5A 250V	48V Field Supply	940-0215
F2	521-0124	AGC 3A 250V	LVPS Power Fuse	940-0007
	521-0118	MDL 0.5A 250V	HVPS Power Fuse	940-0012
	521-0119	AGC 5A 250V	20 – 60V Power Fuse	940-0008
	521-0135	AGC 3A 250V	LVPS Power Fuse	940-0007
	521-0136	MDL 0.75A 250V	HVPS Power Fuse	940-0024
	521-0138	MDL 0.75A 250V	HVPS Power Fuse	940-0024
	521-0139	AGC 3A 250V	LVPS Power Fuse	940-0007
F3, F4, & F5	517-0427	AGC 0.25A 250V	12V / 5 mA Wetting	940-0023
	517-0402	AGC 0.25A 250V	24V / 5 mA Wetting	940-0023
	517-0403	AGC 0.25A 250V	48V Wetting	940-0023
	517-0425	AGC 0.5A 250V	24V / 10 mA Wetting	940-0009
	517-0426	AGC 0.10A 250V	120V Wetting	940-0155
	517-0428	AGC 0.10A 250V	250V Wetting	940-0155
	517-0431	AGC 0.25A 250V	24V / 5 mA Wetting x 16 ch	940-0023
	517-0432	AGC 0.25A 250V	48V Wetting x 16 ch	940-0023
	517-0433	AGC 0.25A 250V	12V / 5 mA Wetting x 16 ch	940-0023
	517-0434	AGC 0.062A 250V	120V Wetting x 16 ch	940-0156
	517-0435	AGC 0.062A 250V	250V Wetting x 16 ch	940-0156
F6	517-0395	AGC 1.0A 250V	Control Voltage Fuse	940-0021
	517-0396	AGC 1.0A 250V	Control Voltage Fuse x 8 ch	940-0021
	All KE	AGC 1.0A 250V	Control Voltage Fuse	940-0021
	517-0454	AGC 1.0A 250V	Control Voltage Fuse	940-0021
	517-0455	AGC 1.0A 250V	Control Voltage Fuse x 8 ch	940-0021
F6 & 7	D25K-4Z	MDQ 3	T/C Control Voltage Fuses	940-0027
F8 & 9	517-0440	MDA 10	DO Control Voltage Fuses	994-0053

Chapter 11: Inside the D25

Overview & Contents

Introduction

The field engineer will use this Chapter as a source of information and procedures for disassembling a D25, and for removing and replacing all of the major components. Some of these procedures may be required when setting option jumpers on internal components.

In This Chapter

This Chapter contains the following Sections and Topics:

Modular Construction

Introduction

Under normal operation, the D25 should not require any disassembly or assembly.

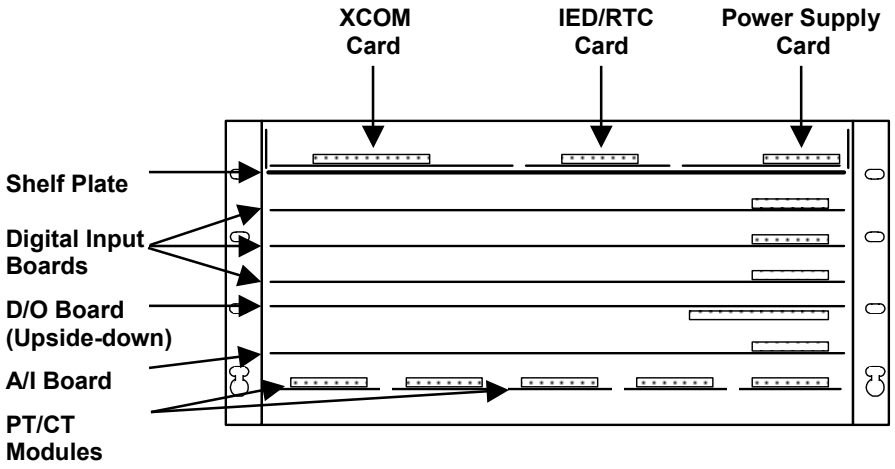
If the unit has sustained damage through physical or environmental factors, or if a module or option has to be interchanged to change functionality, this Chapter will guide you through the process of disassembly or assembly.

General

- All modules are accessed through the front of the enclosure.
- I/O modules can be removed and replaced without disturbing field wiring.
- Each PCB fits into a guide in the enclosure side panels.
- Each daughter board has self-aligning connectors to ensure correct insertion.
- All PCBs of different types are keyed to prevent improper insertion into the wrong location.

Component Location

With the front door open, and the D25 DAC module removed, the modules will be in the locations shown below.



D25 PCB/Connector Layout
(Front View – DAC Card Removed)

Disassembling the D25 IED

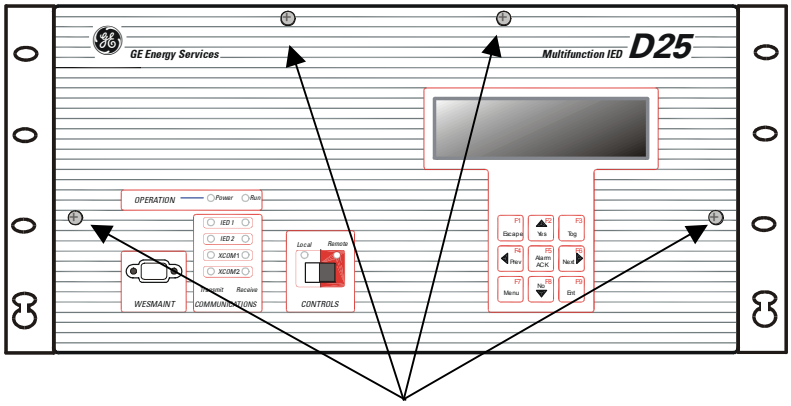
- Always disconnect the power source before servicing and removing components.
- Use puller (located inside of D25 front cover, on the edge of the Indicator Switch Card) to remove and replace modules.

* **Always use the puller provided for removing and replacing all modules.**

Background on Connectors

- Connectors for field wiring the Digital Input, DC Analog input cards, and Digital output cards that use compression type connectors are permanently installed into the rear panel of the D25.
- Some Digital output modules have DB-25 connectors that are permanently attached to the module, not the rear panel.
- PCBs are inserted into or removed from the front of the unit.
- Connectors on the CT/PT transformers are permanently installed into the rear panel.
- The CT/PT primaries are connected to the connectors by quick connect type of connectors.

Front Panel



Captive Screws

Continued on next page

Disassembling the D25 IED, Continued

Disassembly Procedure

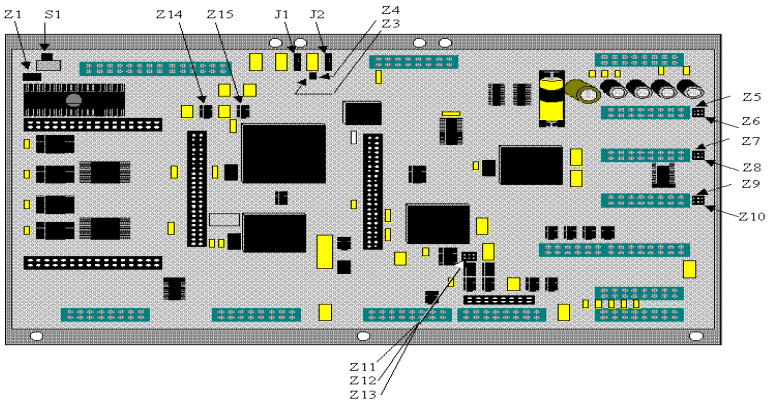
Follow this procedure to remove the front panel and expose the D25 DAC module (Main Board).

Step	Action	Comment
Lower the Front Panel		
1	Loosen the four (4) captive screws visible on the front panel	The front panel is hinged on the metal-formed hinges at the lower front edge of the D25.
2	Lower the panel	This will expose the inner cavity of the D25
Disconnect Indicator Switch Card		
3	Locate the connectors at either end of the ribbon cable.	
4	Push open the connector clips, and gently pull to remove the male connector at the DAC end of the cable	
Remove the Front Panel		
5	With the ribbon cable disconnected, shift the panel to the right.	
6	Pull the panel towards the front to disengage the panel from the slots in the lower front edge of the enclosure.	The panel will now be free of the enclosure

Section 1: The DAC Boards

Type II DAC Board

Type II DAC Board Layout Drawing



Type II Jumper Functions

The following table lists the DAC board jumpers and their functions.

Jumper	Function	Default Setting
J1	Factory use only	JTAG Connector, *Do Not* Jumper
J2	Factory use only	BDM Connector, *Do Not* Jumper
Z1	Selects the BootROM size	Pins 1 - 2 shorted: 256k EPROM Pins 2 - 3 shorted: 512k EPROM
Z2, 3 and 4	Factory use only	Open
Z5 – Z6	Wetting for Low Voltage DI card #1	Pins 1 – 2 shorted: Internal wetting Pins 2 – 3 shorted: External source Z5-2 – Z6-2 shorted: Voltage Detect DI #1 Z7-2 – Z8-2 shorted: Voltage Detect DI #2 Z9-2 – Z10-2 shorted: Voltage Detect DI #3 Note: Jumpers not used with High Voltage DI Cards
Z7 – Z8	Wetting for Low Voltage DI card #2	
Z9 – Z10	Wetting for Low Voltage DI card #3	
Z11 and 12	Factory use only	Pins 2 – 3 shorted:
Z13, 14 and 15	Factory use only	Open

Reset Switch S1

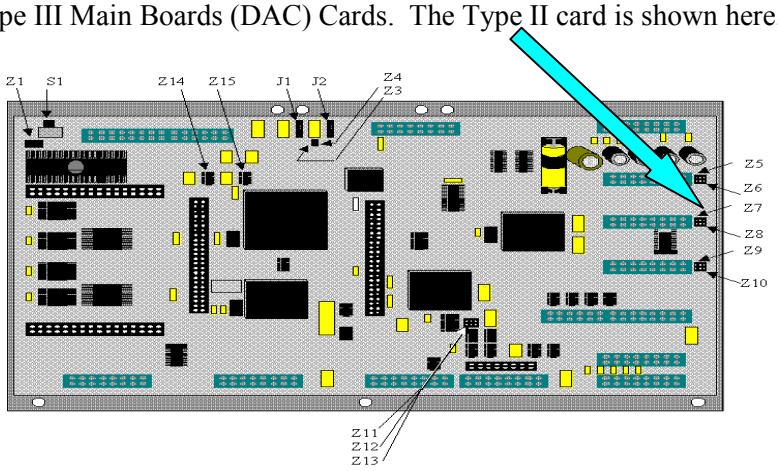
At the top-left of the Type II DAC board is the reset switch S1 that can be used to restart the D25 during test or installation.

Caution: On Type I and some Type II units, the switch is a slide switch that is not momentary. i.e., it can be left in the 'reset' position inhibiting the operation of the D25. Be sure to set the switch to the right-hand position.

Type II DAC – DI Wetting Jumpers

Low-Voltage Digital Input Card Wetting

The jumpers for wetting selection are located on the right edge of both the D25 Type II and Type III Main Boards (DAC) Cards. The Type II card is shown here.



Type II DAC:

Low Voltage Digital Input Wetting Selection

When using low voltage digital input cards, the choice of internal or external wetting supply source, or voltage-detect input may be made using jumpers Z5 to Z10.

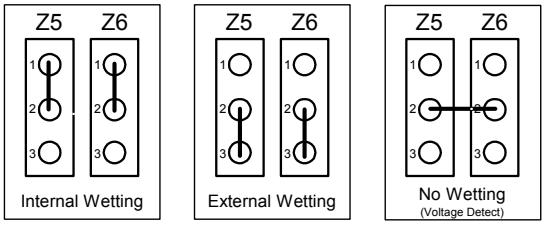
If external wetting supply is to be used:

- connect external wetting supply to pins 1 and 2 on connector A, C and/or E

Digital Input	Internal Wetting	External Wetting	Voltage Detect
1 to 32	Z5-1 to 2 Z6-1 to 2	Z5-2 to 3 Z6-2 to 3	Z5-2 to Z6-2
32 to 64	Z7-1 to 2 Z8-1 to 2	Z7-2 to 3 Z8-2 to 3	Z7-2 to Z8-2
65 to 96	Z9-1 to 2 Z10-1 to 2	Z9-2 to 3 Z10-2 to 3	Z9-2 to Z10-2

Type II DAC Wetting Jumper Detail

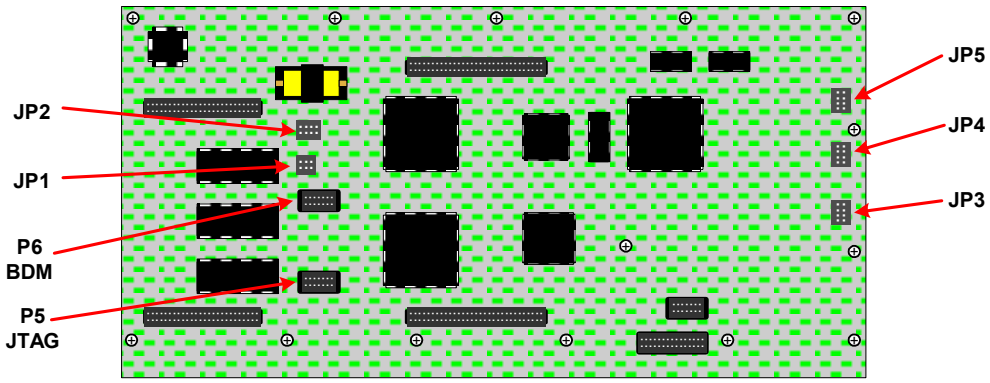
The jumpers shown here are for the first (top) 32-point module. Jumpers (J7, J8 and J9, J10) for the other two modules work in the same way.



Note: Internal-wetting voltage may be 24 or 48 Volts, depending on power supply in use.

Type III DAC Board

Type III DAC Board Layout Drawing



Type III Jumper Functions

The following table lists the Type III DAC board jumpers and their functions.

Jumper	Function	Default Setting
P5	Factory use only	JTAG Connector, *Do Not* Jumper
P6	Factory use only	BDM Connector, *Do Not* Jumper
JP1	Factory use only, jumper 5 – 6 to enable JTAG for programming FLASH or EPLD	No Jumpers on any pins
JP2	Selects EPROM size, and allows for different FLASH memory options	Pins 3 – 5 shorted: 256K EPROM Pins 5 – 7 shorted: 512K EPROM
JP3	Wetting for Low Voltage DI card #1	Pin 1 – 3 and 2 – 4 shorted: Internal wetting Pin 3 – 5 and 4 – 6 shorted: External source Pins 3 – 4 shorted: Voltage Sense Note: These jumpers not used with High Voltage DI Cards
JP4	Wetting for Low Voltage DI card #2	
JP5	Wetting for Low Voltage DI card #3	

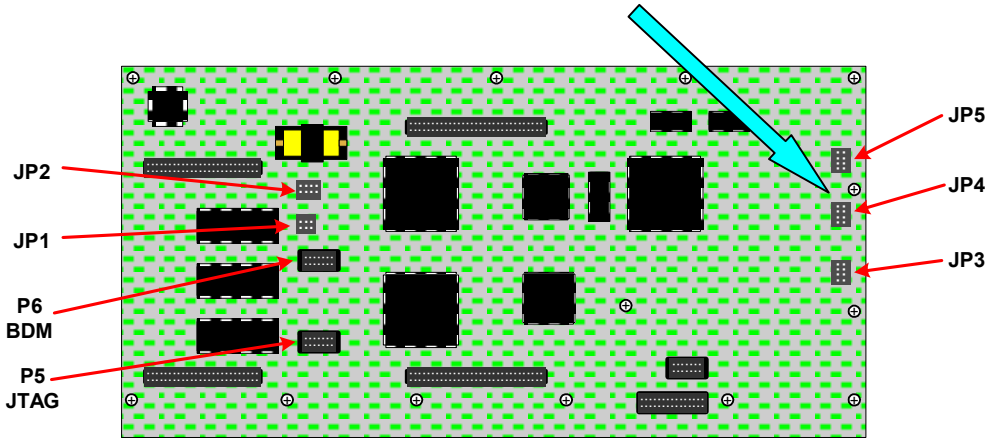
Reset Switch?

The Type III DAC board does not have a "slide" reset switch like Type I and II boards.

Type III DAC – DI Wetting Jumpers

Low-Voltage Digital Input Card Wetting

The jumpers for wetting selection are located on the right edge of both the D25 Type II and Type III Main Boards (DAC) Cards. The Type III card is shown here.



Type III DAC:

Low Voltage Digital Input Wetting Selection

When using low voltage digital input cards, the choice of internal or external wetting supply source, or voltage-detect input may be made using jumpers JP3 to JP5.

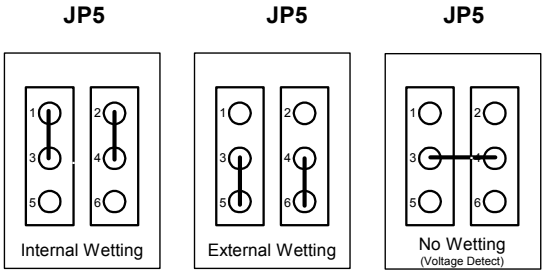
If external wetting supply is to be used:

- connect external wetting supply to pins 1 and 2 on connector A, C and/or E

Digital Input	Internal Wetting	External Wetting	Voltage Detect
1 to 32	JP5-1 to 3 JP5-2 to 4	JP5-3 to 5 JP5-4 to 6	JP5-3 to 4
32 to 64	JP4-1 to 3 JP4-2 to 4	JP4-3 to 5 JP4-4 to 6	JP4-3 to 4
65 to 96	JP3-1 to 3 JP3-2 to 4	JP3-3 to 5 JP3-4 to 6	JP3-3 to 4

Type III DAC Wetting Jumper Detail

The jumpers shown here are for the first (top) 32-point module. Jumpers (J4 and J3) for the other two modules work in the same way.



Note: Internal-wetting voltage may be 24 or 48 Volts, depending on power supply in use.

DAC (Main Board), Battery Replacement

General

The DAC Board is mounted vertically immediately behind the front panel. It is the first component visible when the front panel is removed.

The **Panasonic $BR^2/_3A$** (or equivalent) lithium battery near the top-right of the Type I and II DAC board, or the top-left of the Type III DAC board, is provided to maintain the contents of the NVRAM in the event that power is removed from the D25.

Battery Checking

To check battery voltage, use a meter or other measuring device that has a high input impedance (10 MΩ or higher).

Cleaning & Handling of Lithium Batteries

- Use non-conductive cleaning solution to prevent deterioration of battery performance.
- Dry batteries at a temperature below 85° C to prevent seal deformation that may, in turn, result in leakage.
- Avoid:
  - inversion of polarity
  - exposure to high temperatures, such as soldering or spot-welding
  - excessive force to terminals
- Wear gloves or finger caps when handling batteries to keep them clean.
- For long-term storage
  - keep at temperatures and humidity below normal
  - avoid shorting or loading while stored.

Battery Replacement

If the battery is disconnected, or if the D25 is never powered down, the life of the battery should exceed five years.

The life of the battery will be severely shortened if the battery is left connected while the D25 is powered down for extended periods or stored.

The battery can be changed with power applied to the D25, so that service is not interrupted.

- Removing the battery with power removed from the D25 will result in loss of the configuration data and any other database information stored in NVRAM.
- Downloading the configuration file will be required to restore operation.

- There are many electrostatically sensitive components near the battery.
- Extreme caution and proper procedures for servicing electrostatically sensitive components must be observed.

Continued on next page

DAC (Main Board), Battery Replacement, Continued

Procedure

The procedure for changing the battery with power applied to the D25 follows:

Step	Action
Battery Removal	
1	using a plastic or other non-conductive tool, pry the black plastic clip holding the battery away from the battery holder.
2	when free, the battery and clip can be removed together.
3	remove the clip from the battery, and retain.
Battery Replacement	
4	place good battery into battery holder, carefully noting proper polarity.
5	place clip retained during battery removal across the center of the battery, and press down until it clicks into the retaining notches in the battery holder.

Lithium Battery Disposal

Totally discharged lithium batteries can be disposed of as non-hazardous.

Disposal of a fully or partially charged lithium battery as a hazardous waste can be done *after* it has been first neutralized through an approved secondary treatment.

Section 2: Removing/Replacing Modules

Removing/Replacing the DAC Board:

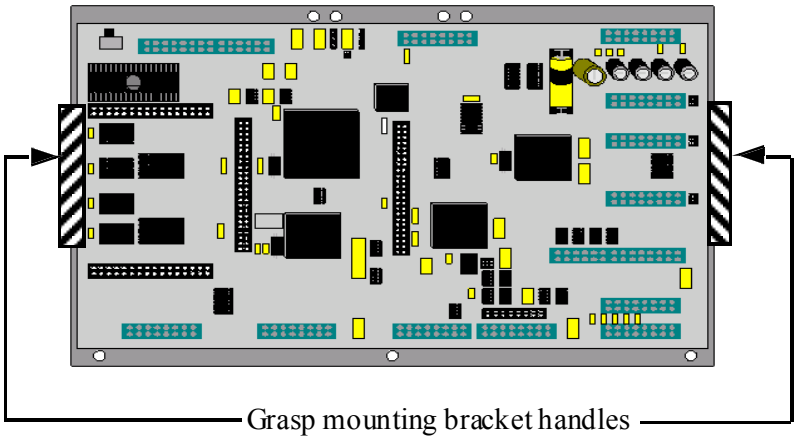
Removal Procedure

Follow this procedure to remove the DAC board.

Before starting this procedure, refer to page 160, *Disassembly Procedure* to remove the front panel and its connections.

Step	Action
1	Locate and loosen the captive screws that hold the metal mounting plate in the D25 housing.
2	Pull the metal mounting bracket at both sides of the DAC Board to disconnect connectors on back of board.
3	Tilt the module slightly so that the metal housing does not obstruct its removal.
4	Carefully slide the mounting plate and attached DAC Board out of the housing.

DAC Board Removal



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Removing/Replacing the DAC Board:, Continued

Replacement Procedure

Follow this procedure to replace the DAC Board:

Step	Action
1	hold the mounting brackets at each side of the module.
2	tilt the card slightly, and insert the top first, ensuring that the battery connections do not come into contact with the metal housing.
3	carefully position the board so that: – the alignment pins align with the holes at the top and bottom of the DAC Board – the captive screws align with their holes – the female connectors on the rear of the DAC Board align with the male connectors of other boards
4	press the DAC Board firmly into position.
5	tighten *all* the mounting screws to ensure the DAC Board connectors are firmly attached and the board is grounded.

Removing/Replacing the DSP/DDSP Modules

General

The Gen. 1 DSP and the Dual DSP (DDSP) modules contain the analog-to-digital conversion and digital signal processing (DSP) circuitry required for processing analog signals from the AC analog input cards.

Location of the DSP Module

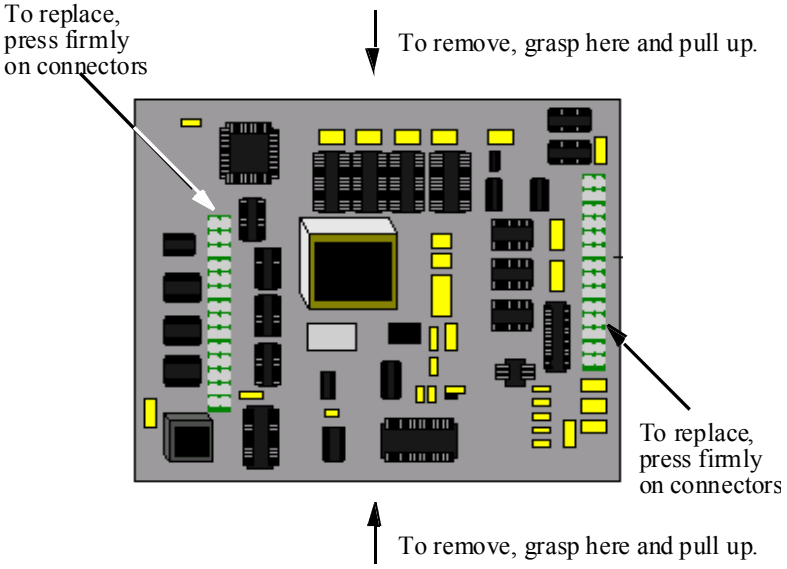
The DSP/DDSP board is mounted on top the DAC Board, just left of center.

Removing the DSP Board

Carefully grasp the board on both sides, and pull away from the DAC Board.

A slight rocking motion may assist in freeing the board from its connectors

Diagram of Type I DSP Module



Note: The DSP card (shown above) is mounted with component side facing out, while the DDSP card is mounted with component side facing toward the DAC main board.

Replacing the DSP Board

1. Carefully position the DSP Board on top of the DAC Board, and align the connectors.
2. Firmly press down on the connectors until completely meshed with DAC board connectors.

POLARIZED CONNECTORS.

The DSP and DDSP Cards can *only* be inserted right side up.

DO NOT ATTEMPT TO INSTALL UPSIDE DOWN.

Removing/Replacing the Memory Expansion Board

General

The memory expansion board is a general purpose RAM card that can provide extra memory for:

- larger, more complex configurations
- file storage for use by the oscillography waveform recording and power quality functions of the D25.

The module is a removable daughter card of the D25 DAC module.

Location

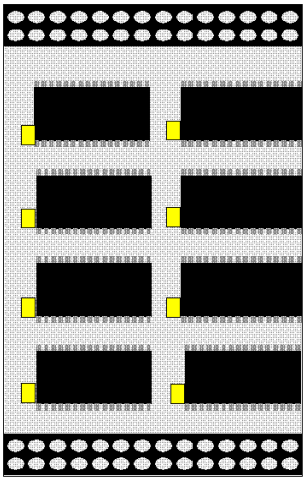
The Memory Expansion module is mounted on top of the DAC (Main) Board.

Removing the Memory Expansion Board

Carefully grasp the board on both sides, and pull away from the DAC Board.

A slight rocking motion may assist in freeing the board from its connectors

Diagram of Memory Expansion Board



Replacing the Memory Expansion Board

1. Carefully position the Memory Expansion Board atop the DAC Board, and align the connectors.
2. Firmly press down on the connectors until completely meshed with DAC board connectors.

Removing/Replacing the Shelf Plate

General

The Shelf Plate is the metal plate that carries the Power Supply, IED/RTC card and the optional XCOM card.

Servicing or replacing any of these components will require the removal of the Shelf Plate.

Locking Brackets

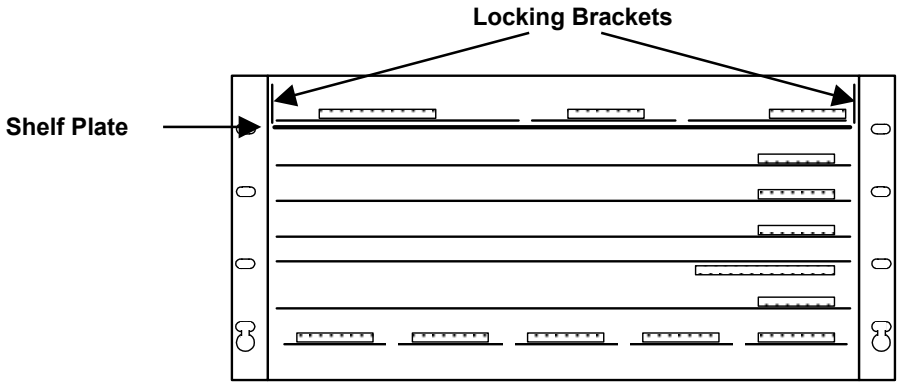
On newer enclosures, two Locking Brackets secure the Shelf Plate, one on each side of the enclosure.

These brackets are designed to prevent the accidental removal of the Shelf Plate when the DAC Board is pulled out of the enclosure

Remove all external connections from the IED/RTC card and/or the XCOM card before removing the Shelf plate.

Shelf Plate Location

Each of the three cards on the Shelf Plate is connected to the DAC Board through a DIN connector.



Field terminations for the Power Supply are made through a five-pin connector positioned on the back panel of the D25.

Continued on next page

Removing/Replacing the Shelf Plate, Continued

Removing the Shelf Plate

After removing all connections from the IED/RTC and XCOM cards:

Step	Action
1	If your enclosure has locking brackets, locate the two levers that secure the metal Shelf Plate in the D25 housing. There are two labels, one on each side panel inside the enclosure, identifying the Locking Bracket locations. 
2	Lift the front end of the locking bracket levers until they click into the up position.
3	Carefully slide the Shelf Plate and attached cards out of the housing.

Replacing the Shelf Plate

Follow this procedure to replace the Shelf Plate.

Step	Action
1	Before inserting the Shelf Plate into the enclosure, lift the front end of the locking bracket levers until they click into the up position.
2	Align the Shelf Plate with the top card guides, and carefully slide the Shelf Plate and attached cards into the housing.
3	Firmly push the Plate into the housing until it is fully engaged into its grounding clips at the rear of the enclosure. Note: The Locking Brackets should fall back into a "locked" position. Check this by pulling on the Plate to see if it is secure.

Configuring Radio Keying Option

General

Revision 7 of the IED/RTC board included a configuration jumper that can be used to enable or disable the Serial XCOM Radio Keying option.

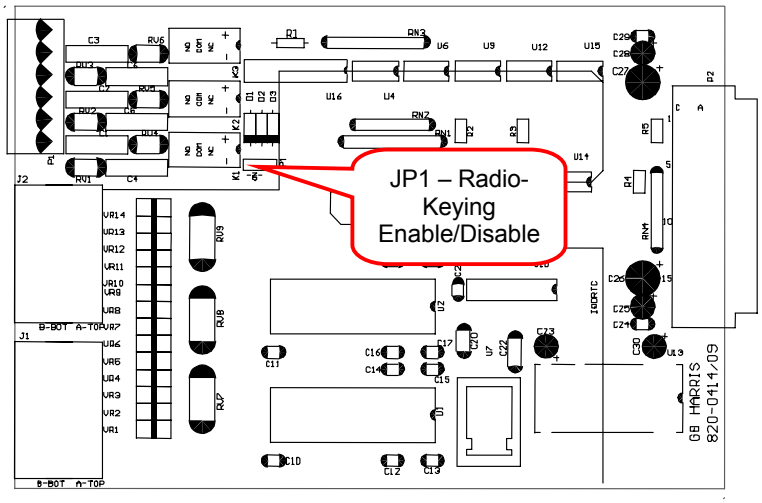
If required, use the following procedure to define the settings for your application.

Option Change Procedure

Follow these steps to access and change the JP1 option jumper on IED/RTC module.

Step	Action
1	Remove the shelf plate as described in the procedure on page 172.
2	Locate the jumper JP1 on the IED/RTC module you are using, referring to the following diagram.
3	Remove the JP1 jumper by pulling it straight up from its pins.
4	Reposition the jumper over the desired pins. Jumper JP1 pins 1 – 2 to enable radio keying Jumper JP1 pins 2 – 3 to disable radio keying
5	Push the jumper straight down onto the two pins
6	Replace the shelf plate into the D25 enclosure.

IED/UTC Card Layout Diagram



Changing Ethernet XCOM Option Jumpers

General

All three variants of the Ethernet XCOM boards have configuration jumpers, with each of the two channels independently configurable with separate jumpers.

The jumpers are factory set to the most common application settings. If required, use the following tables to determine the settings for your application.

Option Jumper Change Procedure

Follow these steps to access and change the option jumpers on any of the Ethernet XCOM module variants.

Note: The *Channel* referred to in the following tables is the number of the XCOM port on the rear of the D25 enclosure. Connector numbering internal to the XCOM modules *may not* reflect the channel numbers.

Step	Action
1	Remove the shelf plate as described in the procedure on page 172.
2	Locate the necessary jumpers for the XCOM module you are using, using the tables on the following tables.
3	Remove the jumper(s) by pulling it straight up from its pins.
4	Reposition the jumper(s) over the desired pin.
5	Push the jumper straight down onto the two pins
6	Replace the shelf plate into the D25 enclosure.

10BASE2 Module Jumpers

** = Factory Settings, *do not* change.

Jumper	Name	Function	Default Mode	Default Setting
Z1	/TEST	Continuous Rx Clock, chan. 2	Disabled	**Out
Z2	/TEST	Continuous Rx Clock, chan. 1	Disabled	**Out
Z3	TSEL	Selects transformer or direct coupled output, chan. 2	Transformer coupled	**Out
Z5	TSEL	Selects transformer or direct coupled output, chan. 1	Transformer coupled	**Out
Z4	SQE	Channel 2 SQE test enable	Enabled	Out
Z6	SQE	Channel 1 SQE test enable	Enabled	Out

Continued on next page

Changing Ethernet XCOM Option Jumpers, Continued

10BASE-FL Jumpers

* = Default Settings

** = Factory Settings, *do not* change.

Jumper	Name	Function	Default Mode	Default Setting
JP4	/TEST	Continuous Rx Clock, chan. 2	Disabled	**Out
JP3	/TEST	Continuous Rx Clock, chan. 1	Disabled	**Out
JP6	TSEL	Selects transformer or direct coupled output, chan. 2	Transformer coupled	**Out
JP5	TSEL	Selects transformer or direct coupled output, chan. 1	Transformer coupled	**Out
Z8	Loopback	Channel 1 Loopback test enable	Enabled	In
Z10	Loopback	Channel 2 Loopback test enable	Enabled	In

JP1	JP2	SQE Test Channel 2	Jabber Channel 2
Out*	Out*	Enabled	Enabled
In	Out	Disabled	Enabled
In	In	Disabled	Enabled
Out	In	Disabled	Disabled

JP9	JP7	SQE Test Channel 1	Jabber Channel 1
Out*	Out*	Enabled	Enabled
In	Out	Disabled	Enabled
In	In	Disabled	Enabled
Out	In	Disabled	Disabled

Continued on next page

Changing Ethernet XCOM Option Jumpers, Continued

10BASE-T Jumpers

The following jumpers are found on both revisions of the 10BASE-T cards. Note that they should not be modified for field applications.

** = Factory settings; *do not* change.

Jumper	Name	Function	Default Mode	Default Setting
JP1	/TEST	Continuous Rx Clock, chan. 2	Disabled	**Out
JP2	/TEST	Continuous Rx Clock, chan. 1	Disabled	**Out
JP4	TSEL	Selects transformer or direct coupled output, chan. 2	Transformer coupled	**Out
JP7	TSEL	Selects transformer or direct coupled output, chan. 1	Transformer coupled	**Out

Revision "0" 10BASE-T Modules

This table should be used for 10BASE-T Ethernet cards that have 820-0431/00 revision of PC boards.

* = Default Settings

JP6	JP9	JP11	JP12	SQE Test Channel 1	Link Test Channel 1	Jabber Channel 1
Out*	Out*	In*	Out*	Disabled	Enabled	Enabled
Out	Out	Out	In	Disabled	Disabled	Disabled
In	Out	Out	Out	Enabled	Disabled	Enabled
Out	In	Out	Out	Enabled	Enabled	Enabled

JP3	JP5	JP8	JP10	SQE Test Channel 2	Link Test Channel 2	Jabber Channel 2
Out*	Out*	In*	Out*	Disabled	Enabled	Enabled
Out	Out	Out	In	Disabled	Disabled	Disabled
In	Out	Out	Out	Enabled	Disabled	Enabled
Out	In	Out	Out	Enabled	Enabled	Enabled

Caution!

Inserting jumpers JP5 and JP8, or JP9 and JP11 at *the same time* will result in possible damage to the Ethernet XCOM module or the D25's power supply.

Follow the information in the above tables carefully.

Continued on next page

Changing Ethernet XCOM Option Jumpers, Continued

Revision "01" 10BASE-T Jumpers

This table should be used for 10BASE-T Ethernet cards that have 820-0431/01 revision of PC boards.

* = Default Setting

One jumper *only* used to make selection	SQE Test Channel 1	Link Test Channel 1	Jabber Channel 1
*JP6 Pins 4-6	Disabled	Enabled	Enabled
JP6 Pins 5-7	Disabled	Disabled	Disabled
JP6 Pins 1-3	Enabled	Disabled	Enabled
JP6 Pins 2-4	Enabled	Enabled	Enabled

One jumper *only* used to make selection	SQE Test Channel 2	Link Test Channel 2	Jabber Channel 2
*JP3 Pins 4-6	Disabled	Enabled	Enabled
JP3 Pins 5-7	Disabled	Disabled	Disabled
JP3 Pins 1-3	Enabled	Disabled	Enabled
JP3 Pins 2-4	Enabled	Enabled	Enabled

Changing Power Supply Field Voltage Output

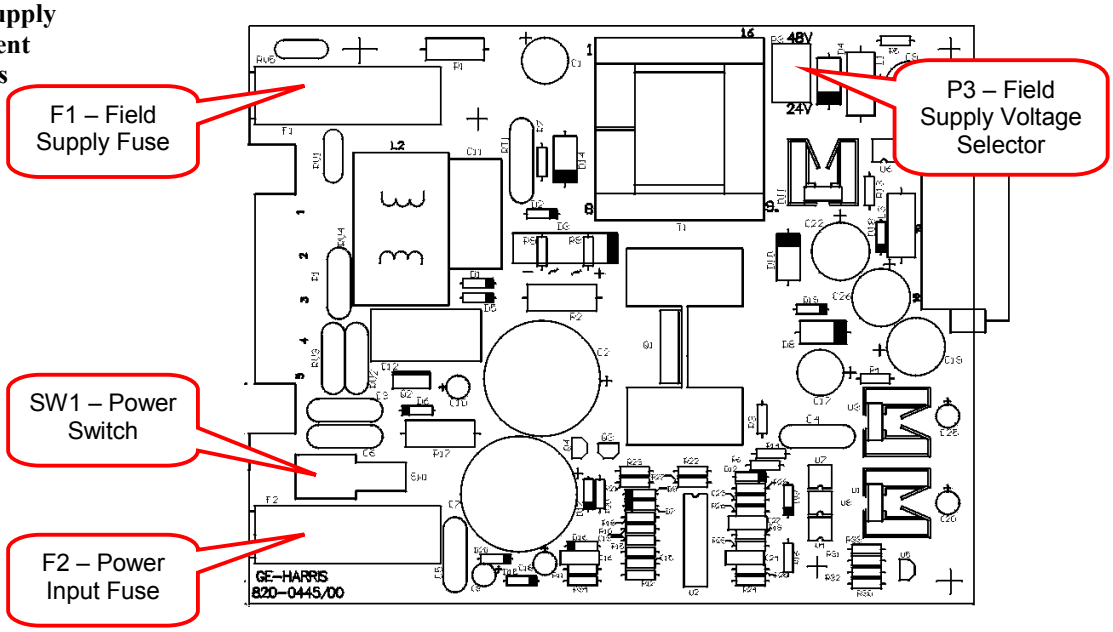
Background

The following optional power supplies have been equipped with a selection jumper that can be used to field modify the field voltage output.

Part #	Default Field O/P	Description
521-0135	24 V_{dc}	LVPS: 60 – 150 V_{dc} / 85 - 135 V_{ac}
521-0136	24 V_{dc}	HVPS: 150 - 350 V_{dc} / 187 - 265 V_{ac}
521-0138	48 V_{dc}	HVPS: 150 - 350 V_{dc} / 187 - 265 V_{ac}
521-0139	48 V_{dc}	LVPS: 60 – 150 V_{dc} / 85 - 135 V_{ac}

All of these power supplies can be switched to provide either 24 or 48 V_{dc} output, by changing the position of the jumper P3

Power Supply Component Locations



Field O/P Change Procedure

Follow these steps to change the field output voltage on any of the four power supplies described above.

Step	Action
1	Remove the shelf plate as described in the procedure on page 172.
2	Locate the jumper P3, as shown in the above diagram.

Continued on next page

Changing Power Supply Field Voltage Output, Continued

Field O/P Change Procedure (continued)

Step	Action
3	Remove the jumper by pulling it straight up from its pins.
4	Position the jumper over the P3 center pin and pin labeled 24V or 48V, as desired.
5	Push the jumper straight down onto the two pins
6	Replace the shelf plate into the D25 enclosure.
7	Remove the fuse F1 from its holder at the rear of the D25 enclosure
8	Replace the fuse with one of the correct value, as seen in this list:

Output Voltage	Fuse Type	Part #
24 V_{dc}	AGC 1.0A 250V	940-0021
48 V_{dc}	MDL 0.5A 250V	940-0215

Note Changing the position of P3 effectively changes the part number of the power supply. Be sure to record and/or label the power supply, identifying the change from the default settings.

Section 3: Removing/Replacing I/O Components

Removing/Replacing the S Cards

General

Refer to Chapter 3 for part numbers.

D25's may be equipped with up to three S-Cards.

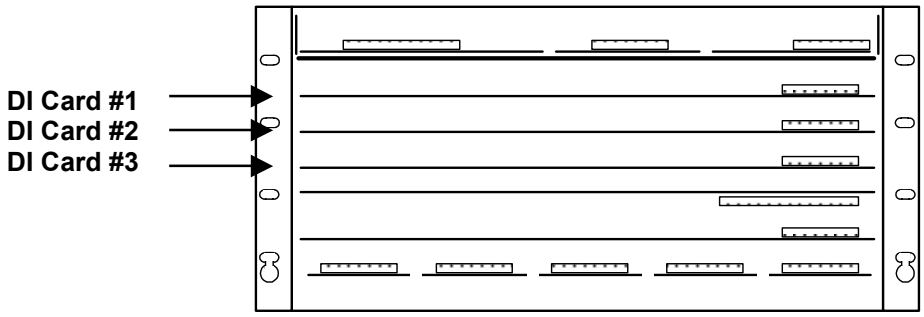
The cards may not be the same part numbers, i.e., the wetting voltage may be different, so use care when replacing cards.

Field terminations for the digital inputs and external wetting power supply are made through two 40-pin card edge connectors positioned on the back panel of the D25.

Always use the PCB pullers shipped with the D25 to remove and replace S Cards.

S Card Locations

Each S Card is connected to the DAC Board through a 2x16 pin DIN connector.



Removing the S Card

1. Use two PCB pullers to slide the S Card toward the front of the D25.
2. Use firm but gentle pressure to disconnect the card.

Replacing the S Card

1. Position the S Card on the slide guide, and carefully push the card into the D25 housing. Use the following table to determine the correct slot to insert the card.
2. Use firm but gentle pressure to push the card into place.

Positioning S Cards

Use this table to determine the correct slot to insert the card.

Card	Inputs	Location
1	1 - 32	second slot from the top of the D25
2	33 – 64	third slot from the top of the D25
3	65 – 96	fourth slot from the top of the D25

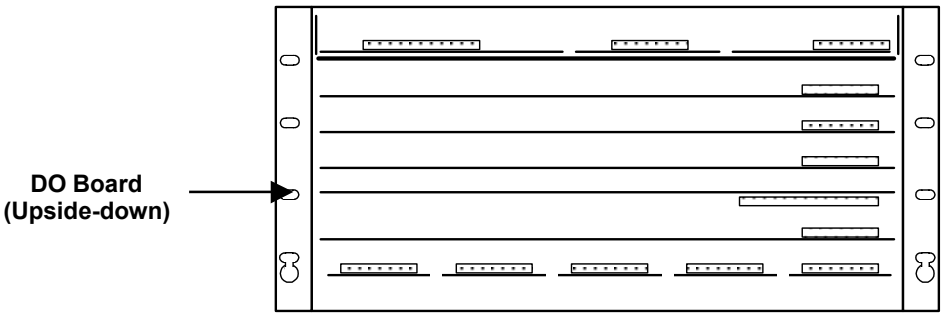
Removing/Replacing the K, K-4Z, KE and KE–4Z Cards

General

Refer to Chapter 3 for part numbers.

Location of K Card

Mount all the K Card variants component-side down in the fifth slot (from the top of the D25).



Always use the pullers shipped with the D25 to remove and replace K Cards.

Removing the K Card

Using one PCB puller, slide the K Card toward the front of the D25.

Use firm but gentle pressure when pulling the card out.

Replacing the K Card

Position the K Card component side down in the fifth slot from the top of the D25, and carefully push the card into the D25 housing.

Use firm but gentle pressure to push the card into place.

THE K CARD MUST BE INSTALLED COMPONENT SIDE DOWN.

Attempts to install the K Card in any other orientation will cause damage to the components.

Removing/Replacing the DC Analog Input Card

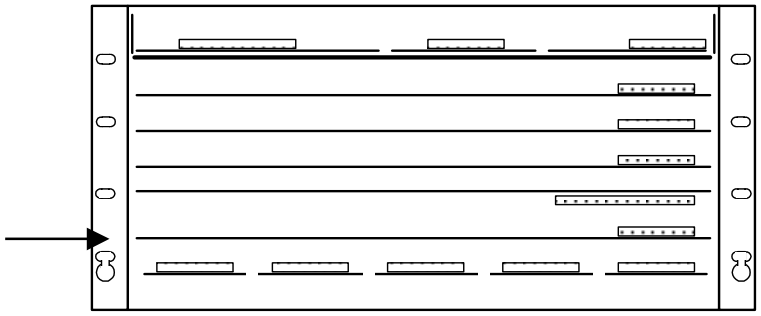
General

Refer to Chapter 3 for part numbers.

Field termination is through one 40-pin card edge connector positioned on the back panel of the D25.

Location of DC Analog Card

The DC Analog Input Card is mounted on the lowest set of slide guides, or slot 6 from the top of the D25.



Always use the pullers shipped with the D25 to remove and replace DC Analog Cards.

Removing the DC Analog Input Card

Use the pullers to slide the DC Analog Input Card toward the front of the D25.

Use firm but gentle pressure when pulling the card out.

Replacing the DC Analog Input Card

Position the ADC Card on the lowest (sixth) slide guide from the top of the D25, and carefully push the card into the D25 housing. Use firm but gentle pressure to push the card into place.

Removing/Replacing the CT/PT Interface Modules

General

The CT and PT interface modules are field replaceable.

Each of the maximum five modules holds three CTs or PTs, for a total of fifteen transformers.

CT INPUT WIRING MUST BE SHORTED EXTERNALLY BEFORE SERVICING THE CT TRANSFORMERS

- Open circuiting a Feeder CT will result in feeder voltage being present at the secondary of the CT.
- These Hazardous Voltages may result in equipment damage, shock, burns or death

Removal Procedure

Follow this procedure to remove the CT and/or PT interface modules

Step	Action
1	Unplug the transformer connectors to disconnect the secondaries from the module.
2	Remove the module by sliding it toward the front of the open D25, then lifting it from the Snap-On PEM studs.
3	Move it forward and out the front of the open D25.

Replacement Procedure

Follow this procedure to replace the CT and/or PT interface modules.

Note: The use of 42x nominal CT modules requires that you enter calibration factors in the D25's configuration. Refer to the following topic for more information.

Step	Action
1	Move the card into position and lower it onto the Snap-On PEM studs.
2	Push it into the D25 until the card snaps firmly in place on the PEM studs.
3	Plug the transformer secondaries into connectors, observing proper orientation and arrangement. Transformer secondary wires should not cross each other.

Removing/Replacing the CT/PT Transformers

CT INPUT WIRING MUST BE SHORTED EXTERNALLY BEFORE SERVICING THE CT TRANSFORMERS

- Open circuiting a Feeder CT will result in feeder voltage being present at the secondary of the CT.
- These Hazardous Voltages may result in equipment damage, shock, burns or death

Note

Before accessing the transformers, you must remove the modules mounted directly above.

Refer to the procedures on the previous page for removal/replacement of those modules.

Background

Due to the stiffness of the wires on the primary of the standard 5 Amp CTs, the transformers are manufactured with wires of two different lengths, to facilitate easier assembly into the bottom of the D25 enclosure.

The part numbers are as follows:

- Standard short lead 5 A CT: 450-0087
- Standard long lead 5 A CT: 450-0088

The optional 42 X 5 Amp CTs are manufactured with *both* long and short primary wires. The unused wire should be removed from the transformer when installed.

- 42 X Overcurrent long/short lead 5 A CT: 450-0108

If replacement 5 Amp CTs are required, be sure to order the transformer with the correct lead length.

Note

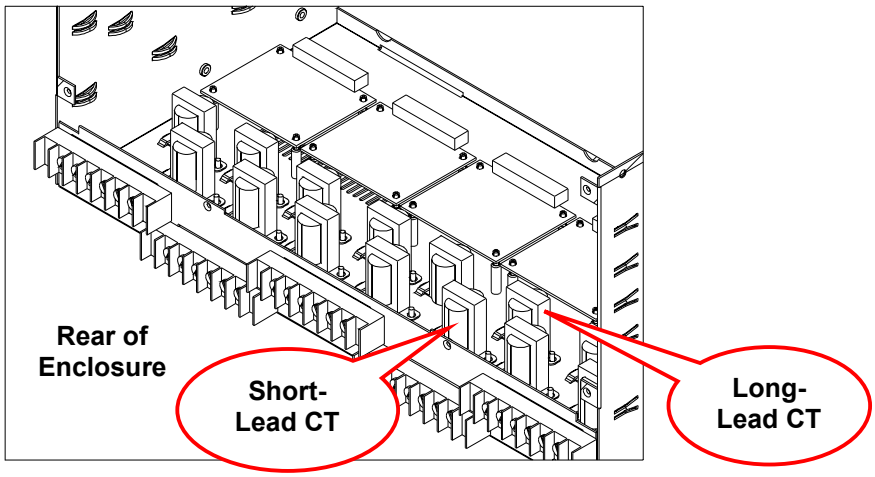
Standard and 42 X overcurrent 1 Amp CTs, and all PTs, have leads flexible enough that two types are not required.

Continued on next page

Removing/Replacing the CT/PT Transformers, Continued

Long/Short Lead Transformer Mounting Diagram

As shown in the following diagram, the short lead transformers are mounted in the row nearest the rear of the enclosure, and the long lead transformers are mounted in the row closest to the front.



Note: The transformer's leads are omitted from the diagram for clarity.

CT/PT Removal Procedure

To remove the CT or PT transformers from the D25 enclosure, follow these steps:

Step	Action
1	Disconnect the quick fasteners on the primary and secondary windings of the transformers.
2	Remove the single nut from the PEM stud
3	Lift the transformer off the stud, and slide it sideways until free of the slot in the bottom plate of the enclosure.
4	Lift the transformer out.

Replacement Procedure

To replace CT or PT transformers into the D25 enclosure, follow these steps:

Step	Action
1	Slide the end of the transformer into the appropriate slot in the bottom plate of the enclosure
2	Lower the other end of the transformer onto the PEM stud.
3	Tighten the nut onto the PEM stud.
4	Replace the quick fasteners onto the primary and secondary connection points.

Replacing a 42x Nominal CT Module

Overview

To compensate for the current transformer's possible magnitude inaccuracy, it must be calibrated using a precision current source.

Use the following procedures to measure the magnitude error at both metering and over-current levels, and then use these measurements to calculate the calibration factors to compensate for the gain error.

Metering Range Calibration (0% - 195%)

Use the following procedure to calibrate the transformer for inputs in the metering range.

Step	Action
1.	Using Config Pro 4: • Set the calibration and correction factors for the phase and magnitude to the following default values: 1.00000 for magnitude, and 0.00000 for phase. – To set the calibration factors, go to D25 AC Configuration>Calibration tab>Internal Calibration tab – To set the correction factors, go to D25 AC Configuration >Calibration tab>External Correction tab. • Set the configured frequency to match the test signal's frequency (either 50 or 60 Hz). – To set the configured frequency, go to: D25 DCA Configuration>Advanced tab>Line Frequency • Set each input's magnitude point Report Deadband to zero and Averaging ON. – To set the Report Deadband, go to: D25 AC Configuration>I/O Configuration tab>Physical AC Analog Inputs>Report Deadband – To set the Averaging, go to: D25 AC Configuration>I/O Configuration tab>Physical AC Analog Inputs>Averaging
2.	Generate and download the configuration to the unit you are calibrating.
3.	For each input use a precision AC current source to inject the test currents indicated in the table in Step 4

Continued on next page

Replacing a 42x Nominal CT Module, Continued

Metering Range Calibration (0% - 195%) (continued)

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4.</td><td>Using the D25 AC Input Engineering Value Displays (available through the B050-0 WESMAINT application), record the raw magnitude values for each input you are calibrating.

Verify that the reported values are within the following tolerances:

<table>
<tr><th>CT Type</th><th>Part Number</th><th>Test Current</th><th>Expected Raw Value</th><th>Tolerance</th></tr>
<tr><td>1 A</td><td>450-0107 (2011087)</td><td>1.000 A_{rms} +/- 0.05%</td><td>2048</td><td>±20 counts</td></tr>
<tr><td>5 A</td><td>450-0108 (2101088)</td><td>5.000 A_{rms} +/- 0.05%</td><td>2048</td><td>±20 counts</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Calculate the 0-195% magnitude calibration factor for each input using the data gathered in Step 4.

Use the following formula:

Magnitude Calibration Factor = expected value / measured value

For example, if the measured value is 2045, the magnitude calibration factor is:

2048/2045 = 1.00147</td></tr>
<tr><td>6.</td><td>Enter the calibration factors in the Magnitude (0% - 195%) column for each input into the configuration
(under D25 AC Configuration>Calibration tab>Internal Calibration tab).</td></tr>
<tr><td>7.</td><td>Generate and download the configuration to the unit.</td></tr>
<tr><td>8.</td><td>Inject the test currents (see the following table) into the inputs, and use the D25 AC Input Engineering Value Displays to verify that the reported raw magnitudes are within the tolerances stated in the following table:

<table>
<tr><th>CT Type</th><th>Part Number</th><th>Test Current</th><th>Expected Raw Value</th><th>Tolerance</th></tr>
<tr><td>1 A</td><td>450-0107 (2011087)</td><td>1.000 A_{rms} +/- 0.05%</td><td>2048</td><td>±4 counts</td></tr>
<tr><td>5 A</td><td>450-0108 (2101088)</td><td>5.000 A_{rms} +/- 0.05%</td><td>2048</td><td>±4 counts</td></tr>
</table></td></tr>
</table>

Continued on next page

Replacing a 42x Nominal CT Module, Continued

Over-current Range Calibration (195% - F.S.)

Use the following procedure to calibrate the transformer for inputs in the over-current range.

Step	Action
1.	Using Config Pro 4: • Set the calibration and correction factors for the phase and magnitude to the following default values: 1.00000 for magnitude, and 0.00000 for phase. – To set the calibration factors, go to D25 AC Configuration>Calibration tab>Internal Calibration tab – To set the correction factors, go to D25 AC Configuration >Calibration tab>External Correction tab. • Set the configured frequency to match the test signal's frequency (either 50 or 60 Hz). – To set the configured frequency, go to: D25 DCA Configuration>Advanced tab>Line Frequency • Set each input's magnitude point Report Deadband to zero and Averaging ON. – To set the Report Deadband, go to: D25 AC Configuration>I/O Configuration tab>Physical AC Analog Inputs>Report Deadband – To set the Averaging, go to: D25 AC Configuration>I/O Configuration tab>Physical AC Analog Inputs>Averaging
2.	Generate and download the configuration to the unit you are calibrating.
3.	For each input use a precision AC current source to inject the test currents indicated in the table in Step 4

Continued on next page

Replacing a 42x Nominal CT Module, Continued

Over-current Range Calibration (195% - F.S.) (continued)

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>4.</td><td>Using the D25 AC Input Engineering Value Displays (available through the B050-0 WESMAINT application), record the raw magnitude values for each input you are calibrating.

Verify that the reported values are within the following tolerances:

<table>
<tr><th>CT Type</th><th>Part Number</th><th>Test Current</th><th>Expected Raw Value</th><th>Tolerance</th></tr>
<tr><td>1 A</td><td>450-0107 (2011087)</td><td>4.000 A_{rms} +/- 0.05%</td><td>8192</td><td>±200 counts</td></tr>
<tr><td>5 A</td><td>450-0108 (2101088)</td><td>20.000 A_{rms} +/- 0.05%</td><td>8192</td><td>±200 counts</td></tr>
</table>
</td></tr>
<tr><td>5.</td><td>Calculate the 195-FS magnitude calibration factor for each input using the data gathered in Step 4.

Use the following formula:

Magnitude Calibration Factor = expected value / measured value

For example, if the measured value is 8195, the magnitude calibration factor is:

8192/8195 = 0.99963</td></tr>
<tr><td>6.</td><td>Enter the calibration factors in the Magnitude (195% - FS) for each input into the configuration (under D25 AC Configuration>Calibration tab>Internal Calibration tab).</td></tr>
<tr><td>7.</td><td>Generate and download the configuration to the unit.</td></tr>
<tr><td>8.</td><td>Inject the test currents (see the following table) into the inputs, and use the D25 AC Input Engineering Value Displays to verify that the reported raw magnitudes are within the tolerances stated in the following table:

<table>
<tr><th>CT Type</th><th>Part Number</th><th>Test Current</th><th>Expected Raw Value</th><th>Tolerance</th></tr>
<tr><td>1 A</td><td>450-0107 (2011087)</td><td>4.000 A_{rms} +/- 0.05%</td><td>8192</td><td>±41 counts</td></tr>
<tr><td>5 A</td><td>450-0108 (2101088)</td><td>20.000 A_{rms} +/- 0.05%</td><td>8192</td><td>±41 counts</td></tr>
</table>
</td></tr>
</table>

Chapter 12: Power-up and Test Your D25

Overview & Contents

Introduction

This section describes a number of systems checks that could be performed to verify that the D25's Plant I/O components and software are functioning properly.

Note

Before any of the tests and procedures in this chapter can be performed, a valid configuration file must be loaded into the D25's NVRAM. Most new D25s will have had a file loaded during manufacture and this file should be still loaded when the unit is delivered to a customer site.

In the event that a valid configuration file is not loaded into the D25's NVRAM, or the file becomes corrupted before the unit is installed, it will be necessary to replace the file before these verification tests can be performed.

If you need help restoring your configuration file, refer to on-line documentation found on your Config Pro CD-ROM.

In This Chapter

This Chapter contains the following Sections and Topics

Required System Components

General

The system components that are required for configuring and testing the D25 are:

- The WESMAINT II+ facility
- The D25 Monitor facility , and
- A Config Pro Configuration system

The functions of these components overlap to a certain extent. It is important to understand the interrelationship among the three.

WESMAINT II+

Each *operational* D25 unit has a WESMAINT II+ facility that allows users to go on-line with the D25 to examine its database, applications and communications, and to manipulate the data.

For example, the state of a digital input data can be examined, or a digital output forced on or off.

Menus and Screens

WESMAINT II+ uses a series of menus and screens displayed on a video monitor to create a simple interface to the D25.

- An operator using a VT100-compatible terminal or a terminal emulation program can gain direct access to the WESMAINT II+ facility. Examples of suitable terminal emulation programs are:
  - Windows HyperTerminal, included on virtually all PCs
  - the Config Pro configuration system's terminal utility
- If your PC (or similar platform) has a TELNET terminal emulation software package, it can be used to connect to a D25 through an Ethernet network link.

Note: For further information about using WESMAINT II+ software, refer to the *WESMAINT II+ User's Guide* (Document Number B014-1UG.68K).

D25's 68K Monitor

The D25's 68K Monitor is a debugging and diagnostics tool that is accessible in two ways:

- As a menu selection available to WESMAINT II+ users.
- Upon start-up of a D25 that has not been previously configured.

Note: For further information about using the D25 Monitor, refer to the *68K Monitor User's Guide* (Document Number SWM0023).

Config Pro

The Config Pro Configuration System is used to define the operational parameters of the D25. Config Pro can be used to download configuration files to the D25 through a serial connection, or through the optional Ethernet TELNET connection available to Windows users.

Note: For further information about Config Pro, refer to the Config Pro on-line help and Tutorial found on the Config Pro 4 CD-ROM.

Section 1: Powering-up the D25

Boot Test Verification

Power On Self Test (POST)

The software installed at the factory includes a Power On Self-Test (POST) process.

This test, which may be done before the D25 is installed or connected remotely, is done to ascertain whether all circuitry is responding and all internal connections are firmly in place.

Follow this procedure to verify the POST process:

Step	Action
1	Move the **CONTROLS** switch on the front panel of the D25 to the right, into the **REMOTE** (Enable) position.
2	Verify that power cable is properly connected to the D25, and the proper power is available. Refer to: page 65 for detail on power connections
3	Locate the power switch on the back of the D25, and toggle it upward into the on position. Results: The **POWER** indicator, a green led on the front panel illuminates when power to the D25 is turned on.

System Diagnostics

The D25 automatically boots, conducting a series of self-diagnostic tests as soon as the power is turned on.

If the D25 fails to function, indicating that a self-diagnostic failure has occurred, it might have sustained internal damage during shipping. Contact GE Energy Services for assistance.

Note

The **LOCAL** LED, **POWER** LED and **RUN** LED will all be on during the self-diagnostic sequence.

Refer to the following page for more detail on indicator LED states during startup.

Diagnostics Completed

Self-diagnostic testing is complete when:

- the Software Application list appears on the PC's monitor, if connected
- if a control card is installed, the **REMOTE** indicator LED will illuminate, and the **LOCAL** LED will extinguish.

Indicator LEDs

Front Panel Indicators

The front panel of the D25 displays several indicators, providing visual clues as to the operational status of the unit.

These indicators are labeled:

- POWER
- RUN
- COMMUNICATIONS
- CONTROLS

LED	Function
POWER	A green indicator that illuminates when power supply is operating normally.
RUN	A green LED on the front panel that illuminates when the D25 microprocessor system is running. **If the DAC board is** / **the RUN LED will….** Type II (504-0005 or 504-0010) — be on, flickering slightly depending on processor load Type III (504-0205) — flash at about 2 Hz, depending on processor load
COMMUNICATIONS	Red LEDs on the front panel provide status information about • IED1 (COM 3) • IED2 (COM 4) • XCOM1 (COM 5) • XCOM2 (COM 6) ports. The LEDs illuminate to indicate whether and when each port is transmitting (TX) and/or receiving (RX). Note: XCOM indicators illuminate *only* if card is installed.

Continued on next page

Indicator LEDs, Continued

Front Panel Indicators (continued)

LED	Function
CONTROLS	The D25 Plant I/O Subsystem monitors the state of the **CONTROLS** switch, *only* if a control board is installed. If the **CONTROLS** switch is in the **REMOTE** position at startup: • The green **LOCAL** LED illuminates immediately when the D25 is turned on. • The green LED remains illuminated until the D25's internal POST diagnostics are complete. • If the diagnostics do not pass, the indicator will remain green. After the D25 has started up normally, the indicator should follow the state of the **CONTROLS** switch. i.e., if the switch is moved to the **REMOTE** position, the red **REMOTE** LED will illuminate after a momentary delay, and the **LOCAL** LED will extinguish.

CONTROLS Switch Operation

General

The operation of this switch *only* affects the circuitry that controls the digital output relays of the D25K, D25K-4Z or D25KE modules.

When operated, the switch has these functions:

Control State as indicated by LEDs	Function
LOCAL	• All physical digital outputs are disabled. • All active operations are aborted. • All digital output requests are rejected. • All queued requests are cleared. • All digital outputs return to the normally open condition as soon as possible and pending requests are eliminated. The D25 cannot operate any digital output points, and therefore permits the safe servicing of connected equipment and wiring.
REMOTE	Physical digital outputs are enabled, and can be operated at any time from: • a host (remotely), or • the WESMAINT II+ interface. Digital output requests are accepted and processed.

The **CONTROLS** switch *does not* affect auxiliary digital outputs

Notes

Moving the **CONTROLS** switch into the **REMOTE** position will not turn on **the REMOTE LED** and allow the D25 to function remotely if the:

- D25 does not have a digital output card installed, or
- an installed digital output card malfunctions.

On-Line Start-up Test

Overview

Whenever a D25 is powered-up or restarted, it's internal processes perform a series of routines, starting with self-tests, followed by the spawning of all the software applications that reside in the unit's memory.

Many of these processes will output progress messages to the D25's 68K monitor, as they are performed. Having a terminal set up to view these start-up messages can provide useful information about the operational status of the unit.

Note

Terminal emulation software is not part of the D25 system, but a terminal software such as Windows' HyperTerminal, or Config Pro's terminal utility can be used or these tests.

For complete instructions about using the emulation software in your stand-alone PC or laptop, refer to the documentation provided with your communications program.

Setup Terminal for WESMAINT

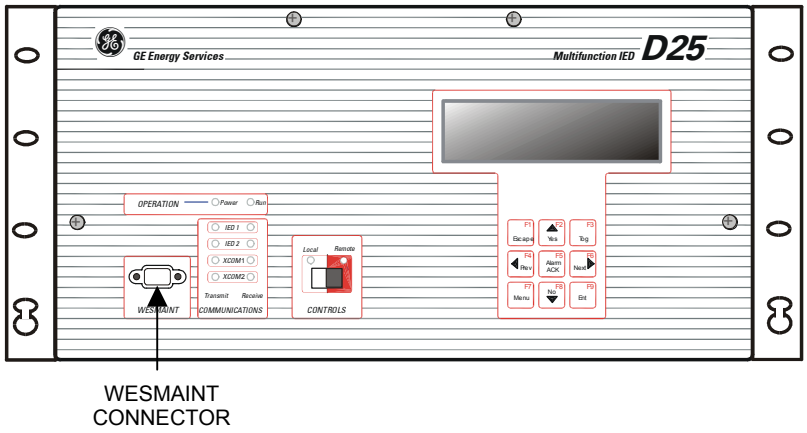
Follow this procedure to setup a PC to act as a WESMAINT II+ terminal

Step	Action
1	Open **HyperTerminal** (provided with Windows 9x, NT and 2000), or other VT100 compatible terminal emulation software.
2	Verify (or set) terminal communications settings as follows: • Data Rate — 9600 bps • Data Bits — 8 • Stop Bits — 1 • Parity — None • Flow Control — Xon/Xoff (software) • Connector settings — (COM1, COM2) as required by the computer being used
3	Click OK.

Continued on next page

On-Line Start-up Test, Continued

Connect to the D25's WESMAINT II+



Step	Action
4	Connect a WESMAINT II+ cable to the female DB-9 WESMAINT II+ port on the front panel of the D25.
5	Attach the other end of the WESMAINT II+ cable to the selected serial communications port of the PC or terminal.
D25 Hardware Setup	
6	Move the **CONTROLS** switch on the front panel of the D25 to the right, into the **REMOTE** position.
7	Verify that power cable is properly connected to the D25, and the proper power is available. Refer to: page 65, *Connecting Power*
8	Locate the power switch on the back of the D25, and toggle it upward into the ON position. Results: The **POWER** indicator, a green led on the front panel illuminates when power to the D25 is turned on.
9	Monitor the VT100 terminal's display. Results: A series of text scripts will be displayed as the POST routines are performed. If not seen, check connections and repeat this procedure.

Note

The D25 automatically boots as soon as the power is turned on.

If the D25 fails to function, it might have sustained internal damage during shipping. Contact GE Energy Services for assistance.

Section 2: Testing Hardware I/O Points

Login to WESMAINT

General

When the POST is complete, you must log in to WESMAINT to continue any further testing.

Login Procedure

To Login, from the PC's keyboard:

Step	Action
1	Press ENTER. Results: The *Welcome* screen appears, including a Login prompt. Note: If the *Welcome* banner does *not* appear, and only a *<D25S* prompt is displayed, a valid code and/or configuration file is not loaded into the D25's memory. Stop this procedure and refer to Chapter 15: *Software Maintenance* where you will find procedures for restoring files.
2	Type the User Name: *westronic* and Press ENTER. (*)
3	Type the Password: *rd* and Press ENTER. (*) Results: The WESMAINT II+ **Main Menu** appears.
4	If a time-out occurs, press ENTER again, to return to the **login** prompt.

Note

(*) The user name and password shown are factory defaults. If you cannot log in, contact your system administrator to obtain new user name and password.

Navigating in WESMAINT II+

- Use the up and down arrow keys, or type in the menu number, to select an option from the Main Menu.
- Press CTRL+L at any time to log out of WESMAINT II+.

Note

For further information about using WESMAINT II+, refer to the *WESMAINT II+ User's Guide* (Document Number B014-1UG.68K).

Digital Input Verification Test

Testing Digital Inputs

In order to see digital input changes as displayed in WESMAINT, first log into WESMAINT as described in the previous pages.

The quantity and relative position of data points in the D25's System Point Database is determined by the version of the D25 Plant I/O software application present in the D25's firmware.

The actual point number that you want to test can be determined by viewing the point descriptions that are displayed in WESMAINT, and/or by referring to the Config Pro configuration tables for this specific D25.

Note: The actual point descriptions seen in WESMAINT will depend on any changes the programmer may have made to the point descriptions in the running configuration file.

Procedure

Note: The following procedure assumes that the digital inputs for this D25 are configured to use *internal* wetting. Refer to page 70, *Internal Wetting* for configuration information.

From the WESMAINT II+ **Main Menu**:

Step	Action
1	Type **1 — System Data Display**.
2	Type **1 — Digital Input Display**. Results: The point numbers and (optionally) point descriptions will appear on the WESMAINT II+ display.
3	Use arrow keys to move up or down to highlight the desired point number. (or press CTRL+G (go to) if point number is already known.)
4	Use a wire jumper to short out the desired input point, and verify that WESMAINT shows that the point status has changed to On.
5	Go back to Step 3 and repeat the test as necessary to test other available digital points.

Navigating through screens

- Press N to move to the Next page.
- Press P to move to the Previous page.
- Press ESC to back up to the previous menu level.

Digital Output Verification Test

Testing Digital Outputs

In order to force digital outputs from WESMAINT, first log into WESMAINT as described in previous sections.

The quantity and relative position of data points in the D25's System Point Database is determined by the version of the D25 Plant I/O software application present in the D25's firmware.

The actual point number that you want to test can be determined by viewing the point descriptions that are displayed in WESMAINT, and/or by referring to the Config Pro configuration tables for this specific D25.

Note: The actual point descriptions seen in WESMAINT will depend on any changes the programmer may have made to the point descriptions in the running configuration file.

Use caution when testing digital output points that are connected to external equipment.

This test may damage external devices, such as relays or reclosers, and may injure personnel.

Procedure

From the WESMAINT II+ Main Menu:

Step	Action
1	Type **1 — System Data Display**.
2	Type in the menu number **2**, to select **Digital Output Display** Results: The point numbers and (optionally) point descriptions will appear on the WESMAINT II+ display.
3	Use arrow keys to move up or down to highlight the desired point number (or press CTRL+G (go to) if point number is already known.). Results: The cursor should bow be flashing on the specified point number.
4	Press CTRL+F when you are ready to force-change the state of the digital output point.
Extra Security	
5	At the **Password** prompt, type ***control*** (*) and press ENTER. Results: The **Digital Output Force Display** appears.
6	Press CTRL+U to change (update) the relay state.

Continued on next page

Digital Output Verification Test, Continued

Procedure (continued)

Step	Action
7	Press the SPACE BAR to select **Pulse** and press ENTER
8	In the **Off time** field, type **500** and press ENTER
9	In the **On time** field, type **500** and press ENTER
10	In the **Repeat Command** field, type **10** and press ENTER twice Results: Listen carefully for an audible click of the point relay. Test is considered successful if the relays click when forced.

Notes

- (*) The password shown is factory default. If you cannot log in, contact your system administrator to obtain the new password.
- The number of time that a control will operate is actually N+1, where N is the number of repeats entered in the **Repeat command** field

Examples: a single operation (i.e., no repeats) type *0*;
for two operations, type *1*

Test Failure

If relays do not operate:

1. ensure that the **CONTROLS** switch is in the **REMOTE** position. No error message will appear in WESMAINT if the test fails.
2. Reboot the D25, and repeat the procedure.
3. Call GE Energy Services for assistance.

Repeat Test

To repeat the test sequence, press CTRL+U. Press ENTER.

Values entered for previous test are retained until menu is exited.

Test Next Point

To test another point, use up or down arrows to cycle through points, then press CTRL+U to repeat test.

Note

The same test procedure can be applied when testing the Aux. Output.

DC Analog Input Verification Test

Testing DC Analog Inputs

The first part of this test will verify that the D25's internal Analog References are operating within their nominal range.

In order to see Analog Input changes as displayed in WESMAINT, first log into WESMAINT as described in previous sections.

The quantity and relative position of data points in the D25's System Point Database is determined by the version of the D25 Plant I/O software application present in the D25's firmware.

The actual point number that you want to test can be determined by viewing the point descriptions that are displayed in WESMAINT, and/or by referring to the Config Pro configuration tables for this specific D25.

Note: The actual point descriptions seen in WESMAINT will depend on any changes the programmer may have made to the point descriptions in the running configuration file.

Procedure:

First, check the Analog Reference values. From the WESMAINT Main Menu:

Step	Action
1	Type **1 — System Data Display**.
2	Use the up and down arrow keys, or type in the menu number *3*, to select **Analog Input Display**, then press ENTER. Results: The point numbers and (optionally) point descriptions will appear on the WESMAINT II+ display.
3	Use arrow keys to move up or down to highlight one of the D25 Plant I/O Analog Reference points
4	Verify that the points display a value close to the values shown in this table:

Description	Nominal Value
Positive DC Analog Reference	4095
Negative DC Analog Reference	-4095
Zero DC Analog Reference	0

Note

- These reference values are monitored by D25 software.
- When the D25 software detects an invalid DC analog reference, it sets the value of the field DC analog points to zero and sets the over-range attribute on those points.

Continued on next page

DC Analog Input Verification Test, Continued

DC Analog Input Test, cont'd.

Continuing from where the previous procedure left off, using the WESMAINT Analog Input Menu.

Step	Action
5	Press CTRL+G and type the number of the first input point (if known), or use the up and down arrow keys to scroll to the desired analog input point.
6	Connect one end of testing leads to a calibrated voltage or current source.
7	Connect the other end of the leads to the first analog input point on the DC analog input termination.
8	Using the following table as a reference, adjust input voltage or current to these levels: • 0% of full scale • 5% of full scale • 95% of full scale
9	Verify that the values displayed in WESMAINT fall near the values shown in the following table.
10	Go back to Step 5 and repeat as desired for other points on the DC analog input termination.

Reference Table

Use this table as a reference for the previous verification test.

DC Input Option	0% FS	Nominal Displayed Count	5% FS	Nominal Displayed Count	95% FS	Nominal Displayed Count
5 V	0 V	0	0.25V	1638	4.75V	31129
1 mA	0 mA		0.05 mA		0.95 mA	
5 mA	0 mA		0.25 mA		4.75 mA	
10 mA	0 mA		0.50 mA		9.5 mA	
20 mA	0 mA		1.0 mA		19 mA	

Notes

- Full-scale for all displayed DC analogs is represented by a range of 32767 to -32768 (15-bit plus sign value).
- Full-scale of DC Voltage and Current measurements is the nominal value.

AC Voltage and Current Input Verification Test

Using WESMAINT to Test AC Analog Inputs

In order to see AC Analog Input changes as displayed in WESMAINT, first log into WESMAINT as described in previous sections.

The quantity and relative position of data points in the D25's System Point Database is determined by the version of the D25 Plant I/O software application present in the D25's firmware, and the circuit configuration loaded into the D25's NVRAM

The actual point number that you want to test can be determined by viewing the point descriptions that are displayed in WESMAINT, and/or by referring to the Config Pro configuration tables for this specific D25.

Procedure

Note: The actual point descriptions seen in WESMAINT will depend on the circuit configuration (i.e., line-to-line or line-to-neutral, etc.) and any changes the programmer may have made to the point descriptions in the running configuration file.

Follow the following procedure to verify that the correct AC voltage and current values are displayed in WESMAINT.

Step	Action
1	Navigate to the WESMAINT II+ System Data Menu.
2	Type **3** — **Analog Input Display**.
PT input test	
3	Press the down arrow key to scroll to the point named *RMS Voltage Phase A Circuit 1*. (see Note: above)
4	Apply nominal voltage to the first AC voltage input termination points.
5	Verify that the measured counts are close to their nominal value.
6	Go back to Step 3 and repeat for other points on the AC voltage (PT) input termination.
CT input test	
7	When voltage input tests are complete, press the down arrow key to scroll to the point named *RMS Current Phase A Circuit 1*
8	Apply nominal current to the first AC current input termination points.
9	Verify that the measured counts are close to their nominal value.
10	Go back to Step 7 and repeat for other points on the AC current (CT) input termination.

Continued on next page

AC Voltage and Current Input Verification Test, Continued

Note

Only points used by the Plant I/O, based on downloaded configuration, will display values.

Unused points will be off-line.

Reference Table

Use this table as example references for the previous verification test.

Note: Nominal values can be determined by reviewing Config Pro's P097 Plant I/O configuration tables for this device.

Point Description	Nominal Value
Voltage Phase A Circuit 1	13107
Voltage Phase B Circuit 1	13107
Voltage Phase C Circuit 1	13107
Current Phase A Circuit 1	2048
Current Phase B Circuit 1	2048
Current Phase C Circuit 1	2048
Neutral Current Circuit 1	2048
Voltage Phase A-B Circuit 2	13107
Voltage Phase B-C Circuit 2	13107
Current Phase A-B Circuit 2	2048
Current Phase B-C Circuit 2	2048
Neutral Current Circuit 2	2048

Notes

- Full-scale for all AC analog values displayed in WESMAINT is represented by a count of 32767 (15-bit plus sign value).
- Full-scale of voltage measurements is 2.5 times the nominal value.
- Full-scale of current measurements is 16 times the nominal value.
- For more detailed information, refer to the *D25 Plant I/O Subsystem P097 Configuration Guide* that matches the Version of the Plant I/O Subsystem that is operating in this D25.

Chapter 13: Upgrading and Replacing a D25

Overview & Contents

After Installation

A variety of upgrade and expansion options are available for the D25 IED.

- Physical point count expansion of the D25 is achieved through combinations of the D25 S, K, AC and DC analog I/O components.
- Communications capability can be changed or enhanced by fitting the unit with the appropriate XCOM card.

Adding the appropriate combination of these cards makes the D25 uniquely suited to individual customer needs

In This Chapter

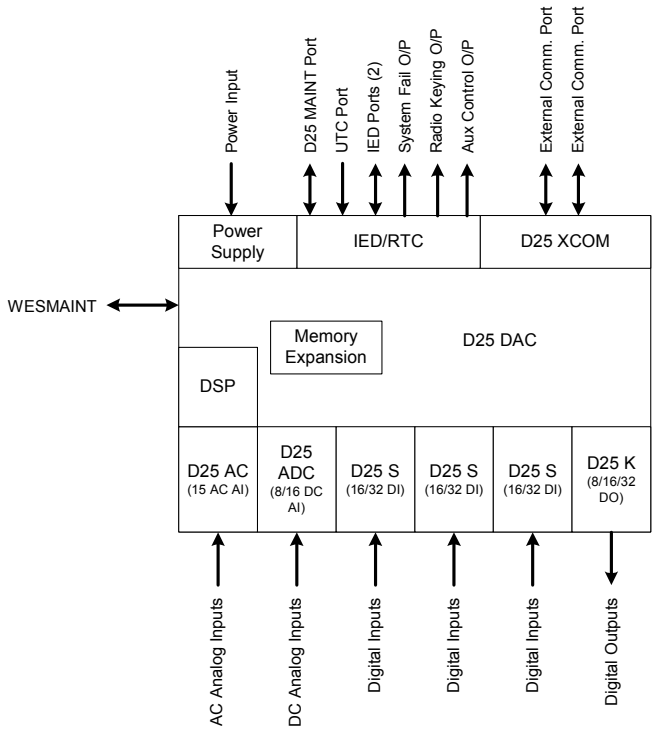
This Chapter contains the following Topics

Upgrading a D25

Ease of Upgrading

D25 is designed for easy field upgrade. The D25 can be upgraded to higher functionality by adding required hardware and upgrading existing software:

- New application software must be configured and downloaded to the FLASH program memory
  - Refer to procedures in Chapter 15: *Software Maintenance* for software upgrading.
- Upgrading hardware is accomplished by simply removing a blanking plate, adding a connector to the rear panel, and inserting the new module from the front.
  - Procedures in Chapter 11: *Inside the D25* illustrate how to insert modules correctly.



Contact GE Energy Services for technical assistance and upgrade options.

Field Replacement of a D25

Purpose

The purpose of this section is to outline a procedure that illustrates how to replace a D25 unit, while leaving as much of the field wiring intact as possible.

Equipment Needed

- Standard electrician's tools (screwdrivers and flashlight)
- Replacement D25 IED

Before Installing

Verify that the replacement D25 unit is fitted with the same options and connectors as the original unit, before proceeding.

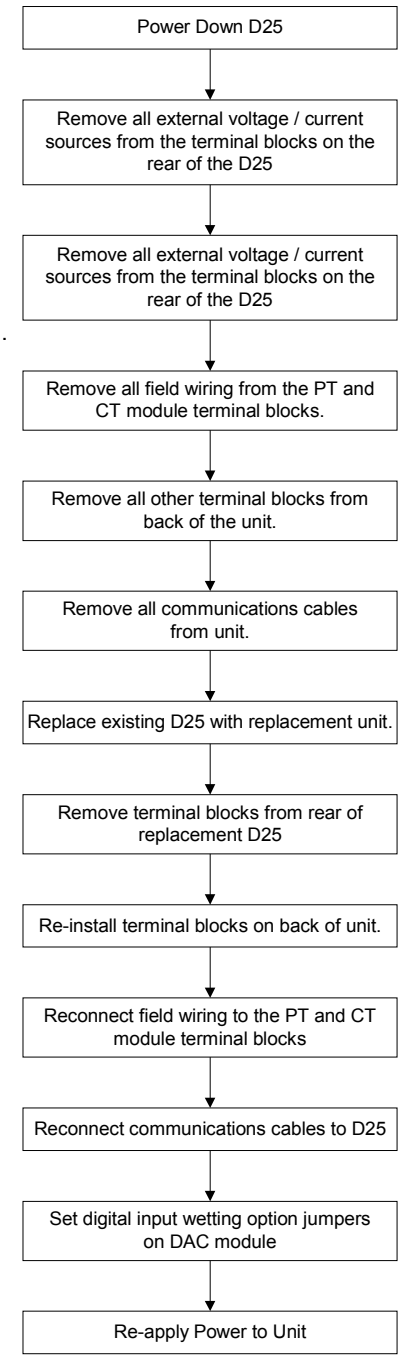
Refer To: Chapter 2: *Before Installation* for detailed information.

CT INPUT WIRING MUST BE SHORTED EXTERNALLY BEFORE DISCONNECTING OR SERVICING THE D25

- Open circuiting a Feeder CT will result in feeder voltage being present at the secondary of the CT.
- These Hazardous Voltages may result in equipment damage, shock, burns or death

D25 Replacement Procedure

Procedure Flow Chart

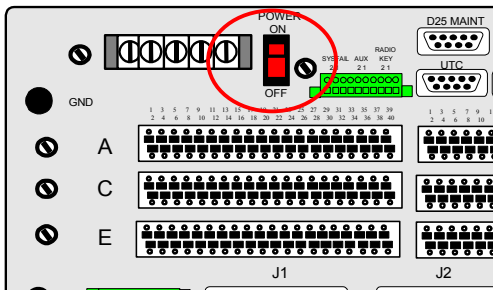
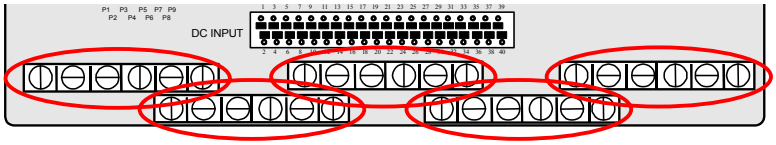


Continued on next page

D25 Replacement Procedure, Continued

Detailed Replacement Procedure

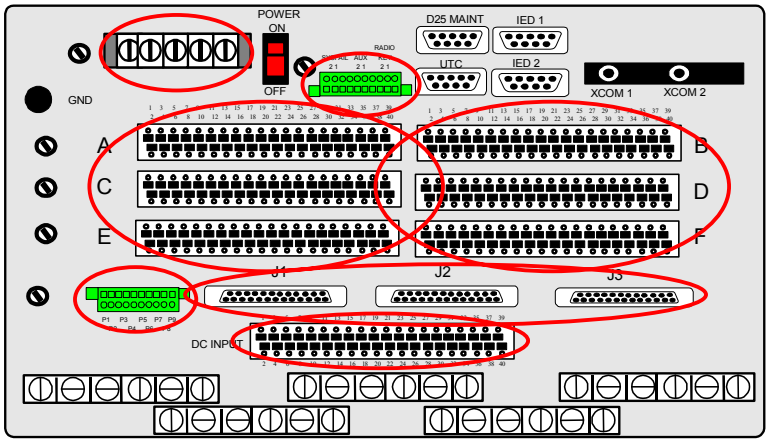
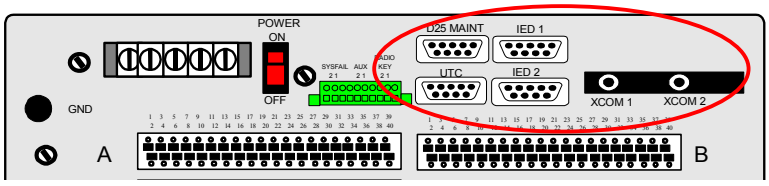
Follow this procedure to replace an installed D25 unit with a new or replacement unit.

Step	Action
	Removing the Existing D25
1	Power down the D25.  Note: The power switch is on the rear of the unit, located near the top left-hand corner.
2	Ensure that there is no voltage or current applied to any of the terminals on the back of the D25. Use a meter if necessary. Note: refer to the "WARNING" section at beginning of this chapter.
3	Remove the field wiring connections to the CT and PT module terminal blocks located at the bottom of the unit.  Important: When the new unit is installed it is important that these wires are reconnected to the same points as they were removed from. Note the position of each wire as it is removed.

Continued on next page

D25 Replacement Procedure, Continued

Detailed Replacement Procedure (continued)

Step	Action
4	Leaving all field wiring still attached, unscrew and remove ALL of the terminal blocks from the rear of the D25 *except* for the CT and PT module terminal blocks (as shown in Step 3 above).  Important: When the new unit is installed it is important that these terminal blocks are placed in the same location and orientation as they were removed from. Note the position and orientation of each of the terminal blocks as it is removed.
5	Remove any communications cables present on the rear of the D25.  Important: Note the location and orientation of each one as it is removed.
6	Remove the disconnected D25 from its mounting rack.

Continued on next page

D25 Replacement Procedure, Continued

Detailed Replacement Procedure (continued)

Step	Action
Installing the Replacement D25	
7	Mount the new D25 in the rack.
8	Remove the same terminal blocks from the rear of the replacement D25 as were removed in Step 4.
9	Reinstall the original terminal blocks onto the rear of the new D25. Important: Ensure that they are placed in the same position and orientation as they were on the original unit
10	Reconnect the field wiring to the PT and CT terminals to the same points as they were on the original unit
11	Reconnect any communications cables that were removed to the same points as they were on the original unit
12	Set digital input wetting option jumpers on DAC module to the same settings as the original unit. Refer to: Page 164, *Low-Voltage Digital Input Card Wetting* for details.
13	Power up the D25

Part IV: Software Installation & Maintenance

Overview & Contents

Introduction

The first Chapter of this Part of the *Installation & Maintenance Guide* will be used by a Field Engineer as a reference for understanding the various software components that enable a D25 to perform its functions.

The second Chapter provides information and procedures where code and configuration files can be maintained.

Note: Generating and downloading configuration files is not discussed in this guide, as it is covered in detail in Config Pro documentation.

The last Chapter provides procedures for a user to test the functionality of the inputs and outputs controlled by the D25 Plant I/O.

In This Part

This Part contains the following Chapters:

Chapter 14: About D25 Software

Overview & Contents

Introduction

The D25 is factory configured and tested, and contains all software required to be a fully functional basic SCADA system that is capable of uploading and downloading configuration databases.

In this chapter

This chapter contains the following topics

System Software

Overview

The D25 system software consists of two distinct components:

1. Base System, and
2. Applications.

Base System Software

The Base System Software resident in the D25 provides a consistent, stable operating environment for the Applications that provide specific functionality to the D25.

The Base System is made up of:

- software that is resident on the BootROM, and
- Base Applications that are required for the operation of the hardware.

D25 BootROM

BootROM software is stored in replaceable EPROM. The BootROM contains:

- pSOS operating system software
- Device drivers to interface the pSOS with the system hardware and software
- Diagnostic tests required to verify the integrity of the D25
- The monitor interface for examining the system in a non-operational mode;
- Startup code that verifies and initializes the application software.
- A stand-alone system for low-level maintenance and troubleshooting.
  - All of the code in the D25 BootROM is duplicated in the standard Base application load. When the D25 is operating the BootROM applications, it does not refer to the applications in the FLASH code, and vice versa.

Base Applications

Standard D25 Base Applications, present in every D25, are:

- WIN – the system database manager
- WESMAINT II+ - allows an operator to examine and control data locally on the D25 system
- 68K Monitor - low-level system maintenance and diagnostic tools

WIN

WIN, an acronym for **W**ESDAC **I**nterface **N**ode, is the database manager for the D25's System Point Database.

The System Point Database is the heart of the D25 software system, where all data flowing through the unit is stored before passing on to its destination.

Continued on next page

System Software, Continued

WESMAINT II+

The WESDAC Maintenance Facility (WESMAINT) is the D25's primary maintenance and diagnostic tool.

WESMAINT can be accessed in three ways:

1. via the serial port on the front of the D25
2. through a modem or other serial connection to a programmed COM port on the rear of the D25
3. over a LAN or serial PPP connection, as a TELNET session from a remote network station

Any WESMAINT access is done with a VT100 terminal, or equivalent terminal emulation software.

Database Display

Standard available displays include:

- digital inputs and outputs
- analog inputs and outputs
- counters (or accumulators)
- device status

Information Display

- AC analog inputs (optional display if inputs exist)
- sequence-of-events (SOE) and change-of-state (COS) data
- system status information
- error log information
- user login buffer
- other application-specific displays

Other Functions of WESMAINT II+

In addition to displaying information, a WESMAINT user can also:

- Temporarily change the stored value of digital or analog inputs
- Set or clear accumulator counts
- Operate digital outputs
- Clear logged information
- Initiate a TELNET connection over a LAN
- Access the D25's 68K Monitor

Continued on next page

System Software, Continued

The D25's 68K Monitor

The D25's 68K Monitor, available through WESMAINT, are diagnostic tools that allow access to system level functions.

The D25's Monitors are resident in both the BootROM and the application bank (Flash memory):

- When operating from BootROM, the prompt that appears is **D25S>**
  - this mode is accessed *only* while the D25 is in a maintenance state
  - forcing a D25 into this monitor will terminate any applications that are running
- When operating from Flash, the prompt that appears is **D25A>**.
  - this is the normal mode of operation, and can be accessed via WESMAINT at any time while the unit is operational

Using the Monitor requires detailed knowledge of the D25 architecture and functionality — both alone and as part of a larger system.

Refer to the *68K Monitor User's Guide* for complete instructions about command usage and availability.

Application Software

Background

A wide variety of applications can be added to the D25's Firmware (FLASH memory) as required to enhance the functionality of the basic D25.

Virtually all of the hundreds of software applications that are available as options for the D25 will fall into one of three categories:

- Data Collection Applications (DCA)
- Data Processing Applications (DPA)
- Data Translation Applications (DTA)

DCAs

Data Collection Applications are responsible for the importing (collecting) of data from external sources, and passing it to WIN (system point database manager) for storage in the system database.

They will also forward output requests from the system database to external sources.

DPAs

Data Processing Applications are configured to select and format (process) data from the system database, and forward it to a SCADA host or Master Station

DTAs

Actually a combination of a DPA and a DCA, Data Translation Applications are able to use data that is in the system database as both input and/or output information.

The DTA will use this data to perform some logical operation, the results of which will create new information.

This new data is then placed back to the system database in a new location, where it can be used as input/output data by some other application.

Firmware

The set of applications that are installed in a D25 is referred to as the Firmware.

The term is used to indicate that the choice of applications is typically determined when the unit is ordered, and are loaded into the D25's Flash memory at that time.

The operational characteristics of a D25 can be changed at a later date, by replacing the Flash memory's contents, or Firmware, with a new file that contains a different list of applications.

Contact your GE Energy Services representative for more information on Firmware upgrades.

Plant I/O Subsystem

Plant I/O Overview

The set of applications that will be present in almost all D25s is the Plant I/O Subsystem. (P097)

The D25 Plant I/O Subsystem is responsible for collecting, processing, and storing all data related to physical inputs and outputs.

Part of the subsystem, the Plant I/O Data Collection Application (DCA) interfaces with the I/O processors to gather their data and to update the system's database.

Through the system database, the DCA maintains an interface that allows other applications access to the data associated with the D25 I/O points.

Main Roles of the Plant I/O

- The Plant I/O is responsible for the timely scanning of all physical I/O points available on the D25.
- For input type points (digital, analog, and accumulator), the data of each scan is compared to previous known data.
- Any changes are recorded in the system database and then reported to other applications as needed.
- Output requests for digital outputs are accepted and processed as soon as they arrive.

Fixed Number of Points

The Plant I/O DCA always has a fixed number of points in the System Point Database.

The actual number of points is determined by the version of the P097 Plant I/O Subsystem that is used in the D25 firmware.

The hardware options available in the D25, and the user's software configuration, will determine whether specific system features and data points will be available or disabled.

Plant I/O Functions

The D25 Plant I/O Subsystem performs the following functions:

- Scanning and processing up to 96 digital inputs and up to 16 DC analog inputs.
- Scanning and processing up to 15 AC analog inputs and associated calculated analogs and accumulators.
- Controlling up to 32 digital outputs, two Master Trip/Close relays and an auxiliary digital output.

Chapter 15: Software Maintenance

Overview & Contents

Introduction

This Chapter starts with a few pages discussing code and configuration files, as they are used in a D25.

The following topics are procedures for removing configuration files from memory, and for installing new or replacement code (firmware) files.

In this chapter

This chapter contains the following topics

About Code and Configuration Files

Background

All D25 units require two distinctly different files to be loaded into memory before the unit will become operational:

- Code File
  - This file is created using GE Energy Services' Software Development System, and is used to define the applications that can be used in a D25 system.
- Configuration File
  - This file is generated using the Config Pro configuration tool, and is used to enable and configure the operational characteristics of the applications defined by the code file.

Extremely Important

It is imperative that the **Code File** and the **Configuration File** loaded into any D25 match perfectly.

More specifically, the configuration file created using Config Pro *must* be based on the same applications, and versions of those applications, that the code file is made up of.

Any differences between the applications in the code and configuration files may result in:

- erratic or unpredictable behavior of the D25
- total lock-up of the D25's software system

How can Configuration and Code File Mismatch Happen?

Here are some common ways that this can occur:

1. the wrong configuration file (i.e., based on a D25 that has a different code file installed) is accidentally downloaded into a unit. This can happen either:
   - through a local serial Config Pro download, or
   - remotely over a LAN connection using TELNET or BootP
2. a code file is downloaded that does not match the configuration file that is presently resident in the D25's NVRAM
3. either the code file or the configuration file has been corrupted, either before or during download

How can Mismatch be Prevented?

Item (1.) above is usually a result of operator or BootP Server configuration error, and can only be prevented by exercising care.

Item (2.) above can be prevented by erasing any configuration file that may be resident in NVRAM *before* downloading a new code file.

Item (3) may require the regeneration of one or both files, and re-downloading.

Continued on next page

About Code and Configuration Files, Continued

How Does the D25 React to This type of Error?

The D25's base system performs this procedure after each reboot:

1. Every time the D25 is rebooted, a counter is incremented.
2. If the D25 runs for 2 minutes without a reboot, this counter is cleared.
3. If the counter ever reaches 20, the base system invalidates the configuration by writing "KILL" into the configuration file without recalculating the file's CRC.
4. The base system then forces a system reset.
5. When the unit comes back up, the base will sense the now-invalid configuration and will create a default configuration instead (or load a stored back-up configuration, if it is available in memory).

Why is This Done?

The intent behind this process is to protect systems that have file problems that cause the system to reset before they can get into WESMAINT to stop things.

While a user can always directly default the configuration by pressing <ESC> during the start-up sequence, this only works if the customer is physically present and connected to the WESMAINT port.

Since the D25 has the ability to receive files remotely over a LAN, the problem may occur when a user is downloading remotely and logging in over TELNET. An error causing a constant reboot would potentially continue forever, filling up NVRAM with a many error messages. This process enables the D25 to eventually settle down on its own.

Deleting Configuration Files

When to Erase a Configuration

Rule: Erase a configuration file from the D25's NVRAM *before* downloading a new code file into FLASH memory, unless the code file is *exactly* the same as the one that was in use before the download.

Three Ways to Erase a Configuration

There are three techniques that can be used to erase a configuration file from the D25's NVRAM:

One Way

Step	Action
1.	Reboot the D25, and while it is starting, press the ESCAPE key. Results: This message will pop-up: `Are you sure you wish to generate a default configuration [y\n]?`
2.	Type *Y* and press ENTER Results: The configuration will now be defaulted.

Second Way

Step	Action
1.	With a terminal connected to the D25's monitor, type *DHW* (**D**isplay **H**ard**W**are) or *SI* (**S**ystem **I**nformation) on older units. Results: A listing of information, including the start address and size of the NVRAM used for the configuration file is displayed. The NVRAM end address can be calculated by adding the NVRAM size to the NVRAM start address.
2.	Type F 00 <NVRAM Start Address> <NVRAM End Address> and press ENTER Results: The specified range of NVRAM will be filled with 0s, erasing any configuration file.

Third Way

Step	Action
1.	With the power removed from the D25, remove the battery on the DAC board for at least 15 minutes. Refer to: page 165, *Battery Replacement* for a detailed procedure for removing and replacing batteries.

D25 Locked-up?

The **Third Way** above will unlock a D25 that has been locked up through a code/configuration file mismatch.

Downloading Code Files

When to Download

There are two reasons for downloading firmware code files:

- If the D25 has performed self-diagnostics and determined that the FLASH memory is either erased or corrupt, it will display the D25S> prompt on the system monitor when it requires code files to be downloaded.
- If the D25 software program features need to be changed or upgraded, the existing FLASH memory can be erased, and new code downloaded.

Choice of 3 Processes

Three techniques for programming the FLASH memory are available. The choice of which to use will depend on system options and network type.

The choices are:

1. A serial connection from a PC to the WESMAINT port, using third-party communications software.
   - This procedure is described below.
2. Use Config Pro 4, either via a serial connection to the WESMAINT port, or via Ethernet using a TELNET and TFTP procedure.
   - These options are described in the Config Pro help menus.
3. A third-party parallel port adapter and software utility is available to connect directly to the BDM port on the D25 DAC Board, allowing for very quick downloads.
   - This is the procedure used during manufacture of the D25.

Before Downloading

When a new code image is downloaded into the FLASH memory of a D25, the amount of memory reserved for the configuration's data region, also referred to as the "Base" region, may not be large enough.

If this occurs, a message similar to this will be displayed:

```
The configuration's data region overlaps the current
Configuration Header (NVHEADER).  Relocate the
Configuration Header / NVRAM to <address>, or set data
size to <size> and re-download.  Application will NOT
be started.
```

If this message appears, refer to the *Config Pro Tutorial* on the Config Pro distribution CD-ROM for the procedures for setting the D25's **Device Properties** to increase the Base Region size.

Note

Using the HyperTerminal communication application that is included in Windows 2000 for a code download procedure can take up to 2 hours to complete.

HyperTerminal with Windows 9X or NT does not appear to have this problem.

Continued on next page

Downloading Code Files, Continued

Prerequisites for Serial Code Download

The following must be available before a FLASH code file can be loaded into a D25's FLASH memory:

- Windows PC with **HyperTerminal** (or equivalent) communication software loaded.
- The code file, in the Motorola S-record format, located on a local hard drive. If the file is located on a network or floppy drive, the download may be significantly slower.
  - This file typically will be named either:

    down.shx, or
    sal*xxxx*.shx
- A WESMAINT cable for interconnecting the PC to the D25's WESMAINT front-panel interface.

Before Starting

- This procedure will suspend all operation of the D25, and following the download, the unit will probably require a configuration download before it becomes operational.
- Consult your System Administrator for access and authorization to perform system download procedures.
- In Application Monitor, (i.e., when the D25A> prompt is displayed) configuration files can be downloaded — but code cannot be downloaded.
- To download code, System Monitor (i.e., when the D25S> prompt is displayed) must be running.

Download Procedure

Follow this procedure to download a firmware file to the D25's FLASH memory

Step	Action
	Access Application Monitor
1	Connect WESMAINT serial cable from PC to the D25's WESMAINT port
2	Start Window's **HyperTerminal** communication software on the PC, and configure it as follows: – 9600 Bps – 8 bit – no parity – VT100 emulation – Xon/Xoff (software) flow control enabled

Continued on next page

Downloading Code Files, Continued

Download Procedure, (continued)

☞ NOTE: If the D25 has no code file loaded, or it has detected a corrupt FLASH file, you will have to go directly to Step 8 and log directly into the monitor.

Step	Action
	Launch System Monitor
3	Log into WESMAINT.
4	Select option **2, System Functions**
5	Select option **3, 68K Monitor** Results: The **D25A>** prompt will appear, indicating that the Application Monitor is running.
6	At the **D25A>** prompt type *rtb* ENTER For other available commands type *help* ENTER
7	At the **Return to the BootROM Operating System? (yes/no)** prompt, type *yes* ENTER Note: The monitor is not case-sensitive, but *Y* is *not* acceptable. Results: The system will restart

⚠ **Invoking this command will completely disable the system.**

	Login to System Monitor
8	After the restart is complete, press ENTER. Results: This will bring up the **Login:** prompt
9	Type the **login name** *harris* ENTER and **password** *rd* ENTER. Results: The system will perform self-diagnostics to ascertain whether any Flash EPROM memory is in use. The **D25S>** prompt will then appear, indicating that the System Monitor is running.
	Clear FLASH EPROM
10	Type *erase* and press ENTER (not case-sensitive) Note: The recommended procedure is to clear to clear Flash EPROM memory — no matter what the system check reveals.

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Downloading Code Files, Continued

Download Procedure, (continued)

Step	Action
11	Type *Y* ENTER at the **Do you wish to proceed?** prompt (not case-sensitive) Results: The system will automatically verify that Flash EPROM memory has been cleared. The **D25S>** prompt will appear. The download can be started.
Optional Step 1: Speed-up communication to shorten download time.	

Warning

- **Changing the speed to a higher rate may increase the probability of a communication error, resulting in failure of the download procedure.**
- **Some third-party communication applications may not be capable of running at these higher speeds reliably.**

If you experience either of these limitations, leave the communication speed at the default value of 9600 bps.

12	Type *Baud 38400* ENTER (speeds up to 38.4 Kbps, may be chosen based on ambient EMI, cable length, PC and software limits etc.) Results: the monitor will now be communicating at 38.4 Kbps
13	Configure the **HyperTerminal** program to communicate at the same speed, and reconnect to the 68K monitor.
Optional Step 2: Provide feedback during download	
14	If the communication software you are using *does not* have any "progress indicator', such as **HyperTerminal**, echo can be enabled to visually display the code file on your monitor as it is transferred. This option can be usually found in the communication settings or properties of the communication program. Note: enabling echo may slow transfer slightly.
Start Download	
15	Type *dl* ENTER
16	Select **Send Text File** (or comparable command) from program menus. Note: Only Motorola S-Records can be downloaded.
17	Locate and select file to download.

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Downloading Code Files, Continued

Download Procedure (continued)

Step	Action
18	Press ENTER to invoke the download procedure. Note: Download may take from 20 to over 45 minutes, depending on file size and speed of transfer. Results: The download completes, the **D25S>** prompt will appear.

Download OK? If the transfer is incomplete or stalls, the transfer must be halted and restarted.

Complete Reboot the D25, watching the display on the PC monitor. Note that D25's monitor speed will return to 9600 Bps, if it was changed during the procedure.

If any error codes are displayed, the procedure may have to be repeated.

Appendix A: Troubleshooting

Run-time and Start-up Problems

Overview

This section indicates what to do when the system malfunctions, or when error messages appear in WESMAINT.

Also note that Plant I/O errors are reported as changes in the state of specific digital input points. These events will be logged in the SOE Buffer Display in WESMAINT

In severe cases, the WESMAINT application may not run at all. If this happens, access the system monitor, and type *EL /P* and press ENTER to display a low-level error log.

If these tables fail to help remedy the situation, or if you need help interpreting error messages, contact GE Energy Services for assistance.

Before Calling

Refer to Page xii, *Support Services and Training* for help in contacting GE Energy Services, and a list of information you can assemble that will aid in the rapid resolution of your problem.

Symptom	Possible Causes	Suggestions
Active Operations Aborted	Controls Switch is in the Local position. D25 Plant I/O Subsystem monitoring detects that the supply voltage is not available.	Move the Controls Switch to the Local position. Verify supply voltage source.
Active Requests Aborted	The D25 Plant I/O Subsystem monitoring detects a conflict between desired and actual coil status (a coil is not energized when it should be).	Verify coil status.
Digital Output Requests Rejected	Controls Switch is in the Local position. D25 Plant I/O Subsystem monitoring detects that the supply voltage is not available. The D25 Plant I/O Subsystem monitoring detects a conflict between desired and actual coil status (a coil is not energized when it should be).	Move the Controls Switch to the Local position. Verify supply voltage source. Verify coil status.
Queued Requests Cleared	Controls Switch is in the Local position. D25 Plant I/O Subsystem monitoring detects that the supply voltage is not available. The D25 Plant I/O Subsystem monitoring detects a conflict between desired and actual coil status (a coil is not energized when it should be).	Move the Controls Switch to the Local position. Verify supply voltage source. Verify coil status.

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Run-time and Start-up Problems, Continued

Symptom	Possible Causes	Suggestions
System Hangs	Watchdog failure	
Plant I/O Watchdog Failure	Plant I/O Subsystem integrity is faulty.	Remove and restore power to the D25.
Digital output Points are Disabled	The Local/Remote switch is in the Local position.	Move the Local/Remote switch to the Remote position.
Communication Watch Dog Failure	Internal system monitors detect serious errors.	
D25 Does Not Operate Remotely	The Local/Remote switch is in the Remote position, but the D25 does not contain a Digital output Card, or the Digital output Card malfunctions.	Verify that a Digital output Card is installed. Verify that the Digital output Card functions correctly.
Coil Status Check	The D25 Plant I/O Subsystem monitoring detects a conflict between desired and actual coil status.	Verify coil status.
Control Voltage Not Available	Output has failed.	
Hardware Watchdog	Digital output coils are not in the state requested by the software Plant I/O Subsystem failure	
Digital Output Failure	Control Voltage Not Available, Coil Status Check, or Hardware Watchdog error condition	
RAM Check Failure	System start-up fails	Use WESMAINT II+ to view the error message.
NVRAM Check Failure	System start-up fails	Use WESMAINT II+ to view the error message.
Application Checksum Failure	System start-up fails	Use WESMAINT II+ to view the error message.
BootROM Checksum Failure	System start-up fails	Use WESMAINT II+ to view the error message.
Start-Up Failure	RAM check, NVRAM check, Application checksum, or BootROM checksum failed during system start-up	Use WESMAINT II+ to view the error message.
System Shut Down	RAM, NVRAM, FLASH, or BootROM internal system diagnostics failed	Use WESMAINT II+ to view the error message.
Only the System Monitor is Running	No valid application code is detected.	Load application code.
Code Download Failure	Download interrupted or data error encountered in downloaded file	Clear Flash EPROM memory. Restart download procedure
Cannot Download Code	Logged into the Application Monitor	Exit Application Monitor, and launch System Monitor

Initialization Errors

Overview

Several error situations related to initialization can occur with file transfers. The most common case will be that the configuration and code in the Boot File are those in the memory of the client causing the client to initialize immediately. Other possibilities exist.

Symptom	Possible Causes	Suggestions
BootROM Error		Press escape to reset
TFTP ERROR	Configuration was not completed or data corruption has occurred at the server	Use WESMAINT II+ to view the error message.
Applications Not Enabled	Configuration was not completed or data corruption has occurred at the server	Use WESMAINT II+ to view the error message.
System Restarts	Data download failure	Use WESMAINT II+ to view the error message.
Only diagnostic input can be entered	No configuration is detected in either NVRAM or in EPROM on start-up	Download a configuration remotely via the system monitor, and reboot
System error	No configuration is detected in either NVRAM or in EPROM on start-up	Download a configuration remotely via the system monitor, and reboot

LAN-Based Errors

General

Several failure cases are possible in the BootP initialization sequence.

Under fault conditions such as loss of one or more devices, the system will continue to operate at whatever level of service is possible — even without LAN address, code, and configuration servers.

Notes

- BootP request time-out is factory set to two (2) seconds.
- The default time-out is 5 seconds.

Symptom	Possible Causes	Suggestions
No response to repeated BootP request	BootP client times out without a valid response. Invalid code and/or configuration	
Null file name for the Boot file appears in the BootP response	BootP server either does not have a Boot File for the device or does not support TFTP read requests	Use WESMAINT II+ to view the error message.
Invalid information in the BootP response	BootP server does not have correct information available for the client. Either the system has not been completely configured, or the BootP server has suffered data loss or corruption.	Use WESMAINT II+ to view the error message.
Late response to BootP requests	Invalid information for the Boot File	Use WESMAINT II+ to view the error message.
Time Out	System waiting for a data block within a file transfer	
Checksum Error	File download time-out	
Run Time Behavior	File name received in a write request is not the Boot File	
Database Tables Created or Modified	File name received in a write request is not the Boot File	
Diagnostics display locally only	Internal hardware verification failure	
Remote Display Failure	LAN stack and diagnostic interface failure	
Time-out	LAN address acquisition failed. Boot File Acquisition failure	Verify that code and configuration are the correct versions.
User Processing Halts	Restart sequence fails to verify address, boot file, code, and configuration	Load updated files for the restart sequence.
Restart Sequence Failure	Address, boot file, code, and/or configuration verification failure	Load updated files for the restart sequence.
Boot File Acquisition Failure	System times out	
Code / Configuration File Acquisition Failure	iSCS device requires code or configuration	Load updated files for the restart sequence.

Appendix B: Engineering Value Calculations

Conversion Formulas

Introduction

This appendix provides information to assist the user in interpreting the data point values seen in WESMAINT.

The following tables provide:

- DC Analog Input Engineering value Calculation Formulas
- AC Analog and Accumulator Input Engineering value Calculation Formulas

DC Analog Formulas

The following table provides formulas for converting DC analog input values from raw system database counts to engineering units.

Input Type	Engineering Value Calculation	Engineering Unit
Voltage	$\frac{RawCount * NomInputVoltage}{32767 * AnalInputScalingFactor * 0.01}$	V
Current	$\frac{RawCount * NomInputCurrent}{32767 * AnalInputScalingFactor * 0.01}$	mA

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Conversion Formulas, Continued

AC Analog & Accumulator Formulas

This table provides formulas for converting AC analog and accumulator input values from raw system database counts to engineering units.

Input Type	Engineering Value Calculation	Engineering Unit
Voltage: (RMS, Symmetrical Components)	$\frac{2.5 * RawCount * Vnom}{32768 * 1{,}000}$ *Vnom* = Nominal input voltage	kV
Current: (RMS, Symmetrical Components)	$\frac{16 * RawCount * Inom}{32768}$ *Inom* = Nominal input current	A
Phase Angle	$\frac{360 * RawCount}{32768}$	Degrees
Frequency	50 Hz Circuit $\frac{(RawCount - 1) * 10}{32766} + 45$ 60 Hz Circuit $\frac{(RawCount - 1) * 10}{32766} + 55$	Hz
Power (per phase): Active, Reactive, Apparent	$\frac{RawCount * Vnom * Inom}{0.75 * 32768 * 1{,}000{,}000}$	MW, MVAr, MVA
Power (per circuit): Active, Reactive, Apparent	$\frac{4 * RawCount * Vnom * Inom}{32768 * 1{,}000{,}000}$	MW, MVAr, MVA
Energy (per phase): Active, Reactive, Apparent	$\frac{65536 * RawCount * Vnom * Inom}{Freq * 3600 * 0.75 * 32768 * 1{,}000}$	kWh, kVArh, kVAh
Energy (per circuit): Active, Reactive, Apparent	$\frac{65536 * 4 * RawCount * Vnom * Inom}{Freq * 3600 * 32768 * 1{,}000}$	kWh, kVArh, kVAh
THD, Voltage Unbalance	$\frac{100 * RawCount}{32768}$	%
Power Factor	$\frac{RawCount}{32767}$	
References	*RawCount*	