## Installation

Three 28 V dc supplies are wired from I/O racks R, S, and T to plugs P1, P2, and P3. The primary 28 V dc output comes from plug JA1 and is wired to the trip board TRPL. The power monitoring signals are wired to the top terminal block (TB1) and go to an analog input board. The secondary voltage outputs are wired to the lower terminal block (TB2) as shown in the following figure.
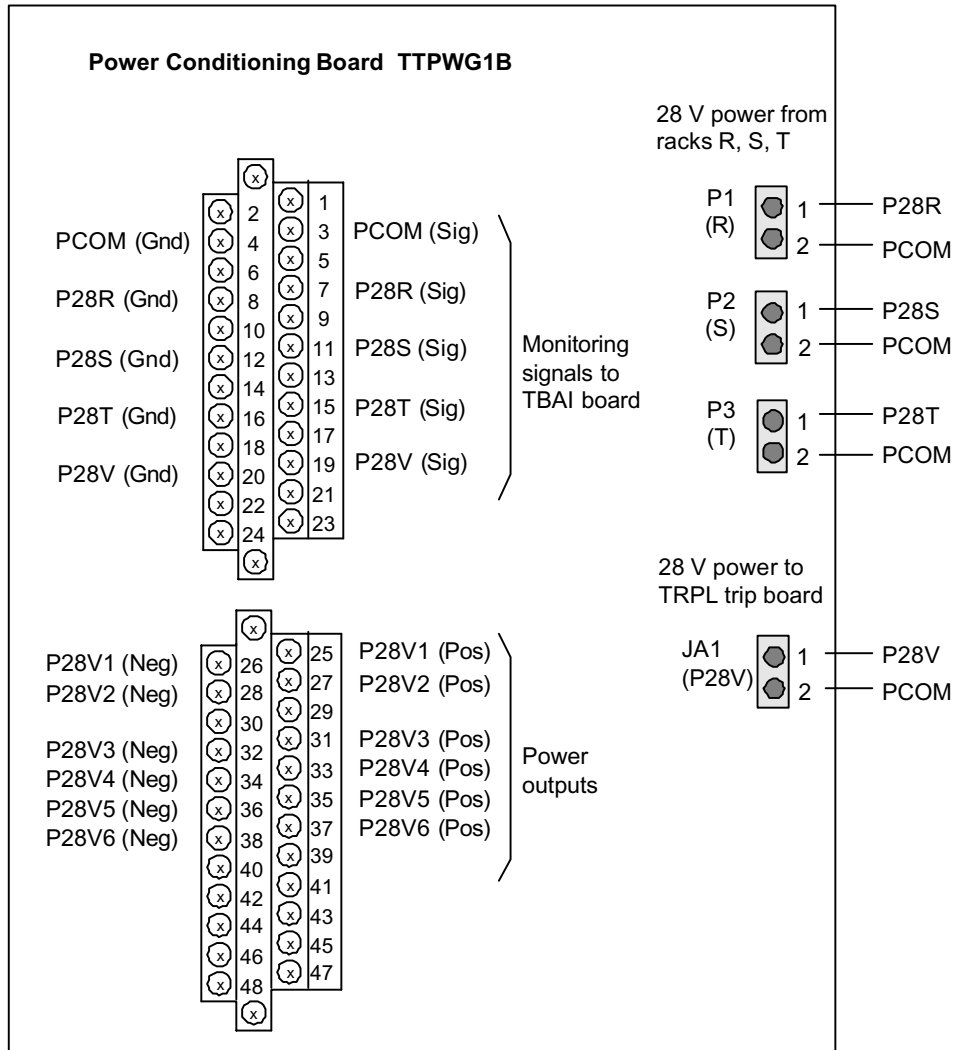
*TTPWG1B Board with Wiring and Cabling*

TTPWH1A

The TTPWH1A power conditioning board provides branch circuit protection and distribution between one or more Mark VI rack mounted +28 V dc power supplies and discrete wiring to peripheral devices. The H1A has three 2-pin inputs for +28 V dc from the Mark VI power supply. It provides diode *OR* selection between the three inputs to power the +28 V dc outputs. Outputs are rated 22 – 30 V dc, 0 – 0.25 A individually and capable of parallel operation. There is high frequency isolation between the inputs and the outputs and the voltage drop is less than +4 V dc when delivering rated current.

The TTPWH1A internal signal paths are shown in the following figure. Nine current limited 0.25 A outputs are provided and may be paralleled for higher current applications.

Typical applications power the H1A from the P28C output of the VME rack power supply. When this is done, the isolation jumper on the rack is placed in the isolated position removing all connections between the P28C output and the rack. The TTPWH1A then provides a resistive bridge to ground to center the power circuit with respect to ground. Voltage feedback monitoring signals are provided using 0.1% resistors allowing monitoring of three input voltages, output voltage, and voltage between PCOM and SCOM.
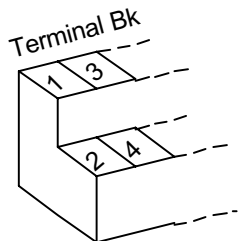
The +28 V dc power source should have an isolated common (return), especially if the load is external to the cabinet and is grounded. Wiring from the rack power supplies through TTPWH1A to the trip board is shown in the following figure.
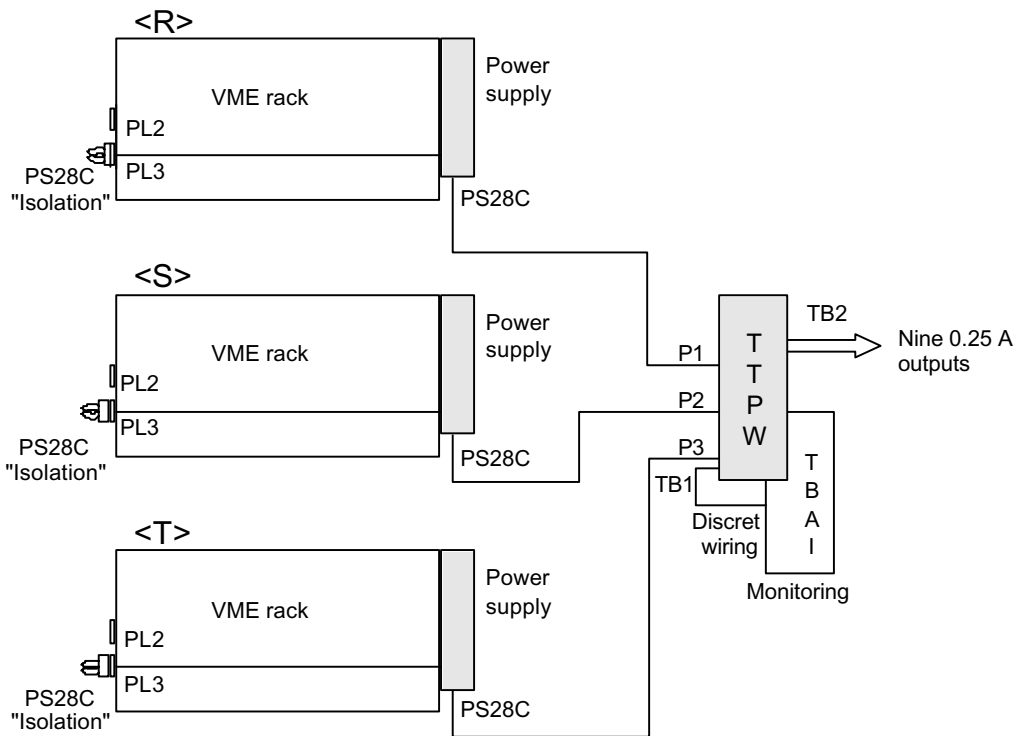
TTPWH1A Application Diagram

Installation

Three 28 V dc supplies are wired from I/O racks R, S, and T to plugs P1, P2, and P3. The power monitoring signals are wired to the top terminal block (TB1) and go to an analog input board. The secondary voltage outputs are wired to the lower terminal block (TB2) as shown in the following figure.
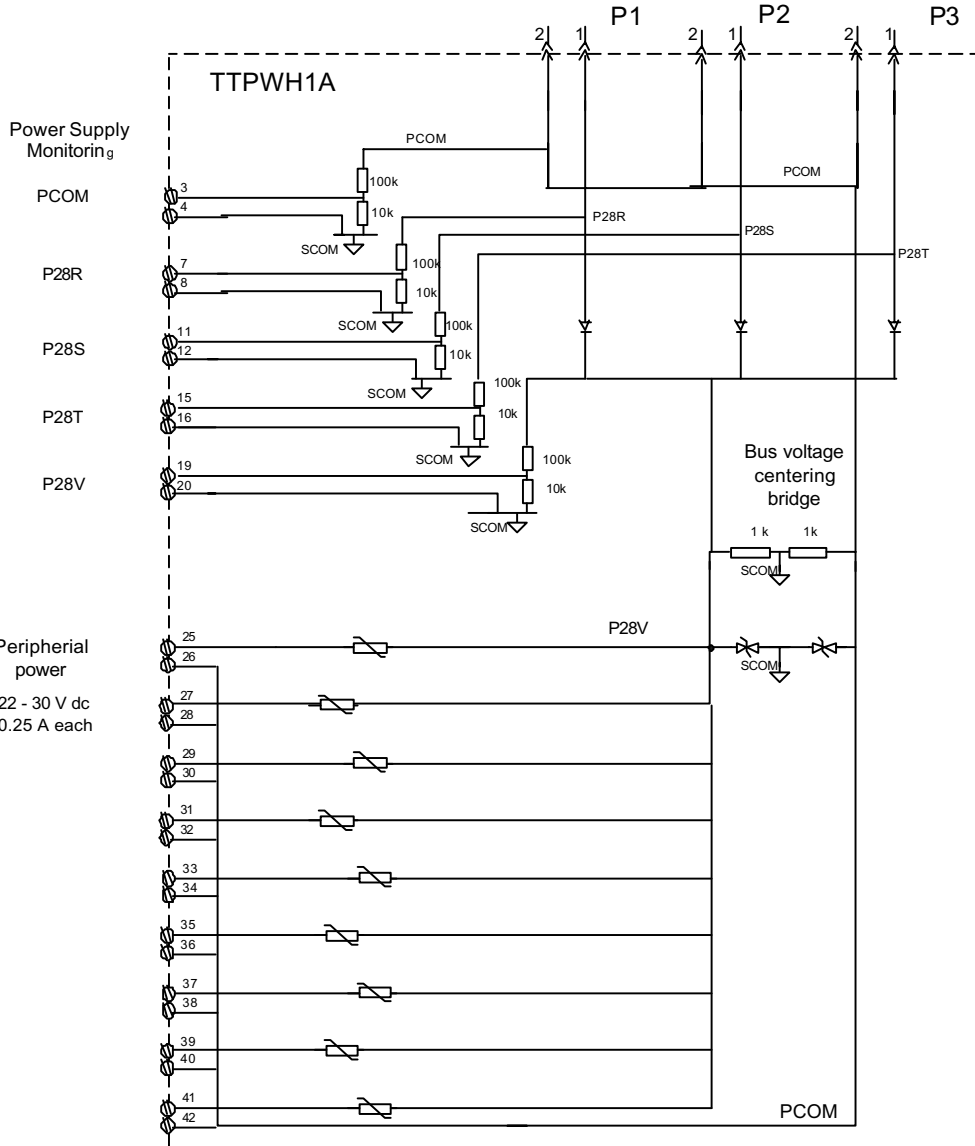
TTPWH1A Board Block Diagram

Power Conditioning Board TTPWH1A

28 V power from
racks R, S, T

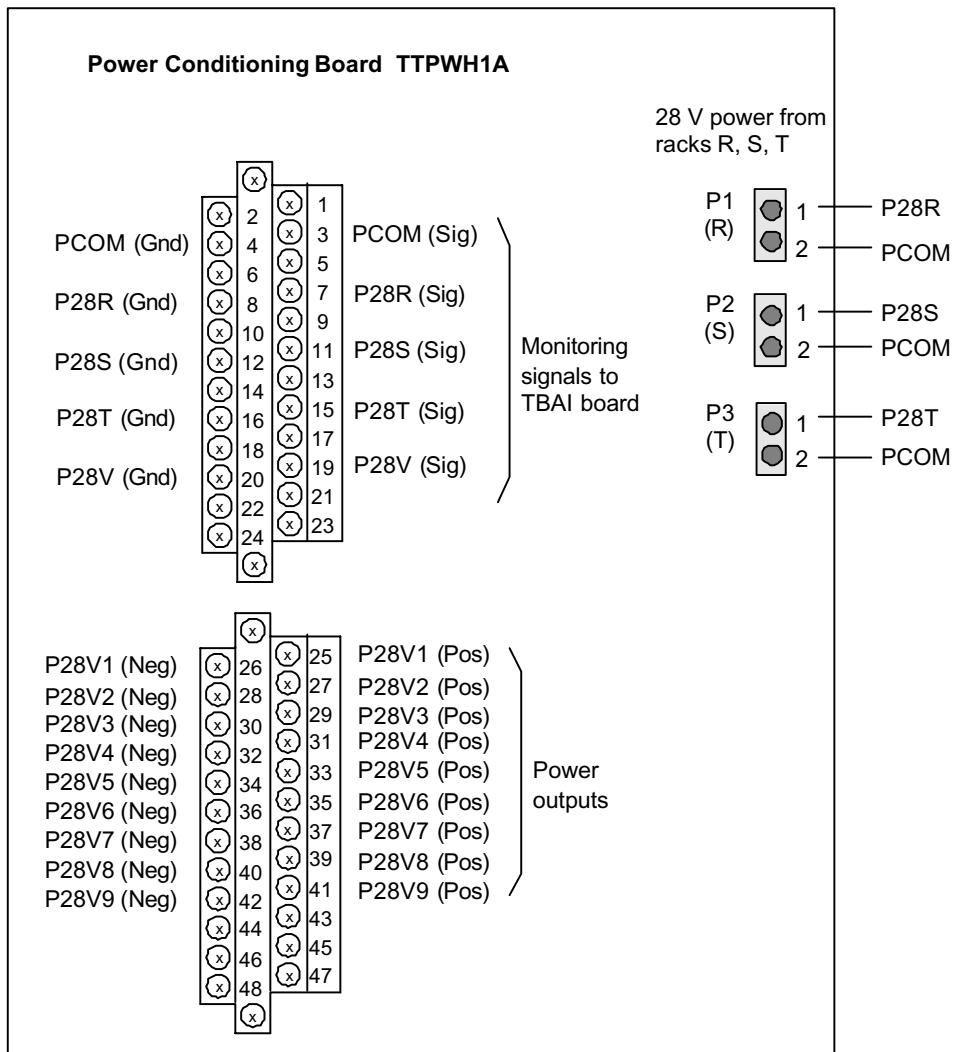|	
	⊗
⊗ 2	⊗ 1
PCOM (Gnd) ⊗ 4	⊗ 3 PCOM (Sig)
⊗ 6	⊗ 5
P28R (Gnd) ⊗ 8	⊗ 7 P28R (Sig)
⊗ 10	⊗ 9
P28S (Gnd) ⊗ 12	⊗ 11 P28S (Sig)
⊗ 14	⊗ 13
P28T (Gnd) ⊗ 16	⊗ 15 P28T (Sig)
⊗ 18	⊗ 17
P28V (Gnd) ⊗ 20	⊗ 19 P28V (Sig)
⊗ 22	⊗ 21
⊗ 24	⊗ 23
	⊗

Monitoring
signals to
TBAI board

P1
(R)   1 —— P28R
       2 —— PCOM

P2
(S)   1 —— P28S
       2 —— PCOM

P3
(T)   1 —— P28T
       2 —— PCOM

	⊗
P28V1 (Neg) ⊗ 26	⊗ 25 P28V1 (Pos)
P28V2 (Neg) ⊗ 28	⊗ 27 P28V2 (Pos)
P28V3 (Neg) ⊗ 30	⊗ 29 P28V3 (Pos)
P28V4 (Neg) ⊗ 32	⊗ 31 P28V4 (Pos)
P28V5 (Neg) ⊗ 34	⊗ 33 P28V5 (Pos)
P28V6 (Neg) ⊗ 36	⊗ 35 P28V6 (Pos)
P28V7 (Neg) ⊗ 38	⊗ 37 P28V7 (Pos)
P28V8 (Neg) ⊗ 40	⊗ 39 P28V8 (Pos)
P28V9 (Neg) ⊗ 42	⊗ 41 P28V9 (Pos)
⊗ 44	⊗ 43
⊗ 46	⊗ 45
⊗ 48	⊗ 47
	⊗

Power
outputs

TTPWH1A Wiring and Cabling Diagram

GE Industrial Systems

Power Distribution Module (PDM)

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Section	Page

Functional Description

The Power Distribution Module (PDM) provides 125 V dc and 115 V ac (or 230 V ac) to the Mark VI system for all racks and terminal boards. There is a second version of the PDM for the control cabinet in those systems using remote I/O cabinets.

Diagnostics to
VCMI through J301
in <R> rack

Power cables to
interface modules
125 V dc, 115/230 V ac

DIN-rail
termination
board

Output power
connectors

Power Distribution Module
(for interface modules)

TB2   TB1

TB3

Input
terminals

Filtered dc
and ac power
to PDM

Power
filters

JTX1
115 V

**AC/DC
Converter**

Cable to
transformer
inside ac/dc
converter

JTX2
230 V

JZ

Cable to
PDM JZ2
or JZ3

TB1

TB2

Customer's power
cables, 125 V dc
and 115/230 V ac

One or two converters

*Power Distribution Module, Ac to Dc Converter, and Diagnostic Cabling*

Operation

The customer's 125 V dc and 115/230 V ac power is brought into the PDM through power filters. The ac power is cabled out to one or two ac/dc converters which produce 125 V dc. This dc voltage is then cabled back into the PDM and diode coupled to the main dc power, forming a redundant power source. This power is distributed to the VME racks and terminal boards.

Either 115 V ac or 230 V ac can be handled by the ac/dc converters. The transformer cable must be plugged into either JTX1 for 115 V ac, or JTX2 for 230 V ac operation.

Diagnostic information is collected in the PDM and wired out to a DIN rail mounted terminal board. A cable then runs to the VCMI in rack <R> through J301.

Ac feeders, J17-20, are fused and cabled out to the relay terminal boards. 125 V dc feeders are fused and cabled to the interface (I/O) cabinets, protection modules, TRPG, TREG, and TRLY. To ensure a noise free supply to the boards, the PDM is supplied through a control power filter (CPF) which suppresses EMI noise. The CPF rack holds either two or three Corcom 30 A filter modules as shown in the following figure.

Power to the contact inputs first passes through resistors R3 and R4, through TB2, before being fused and cabled to the TBCI boards. Contact inputs operate with 125 V dc excitation.
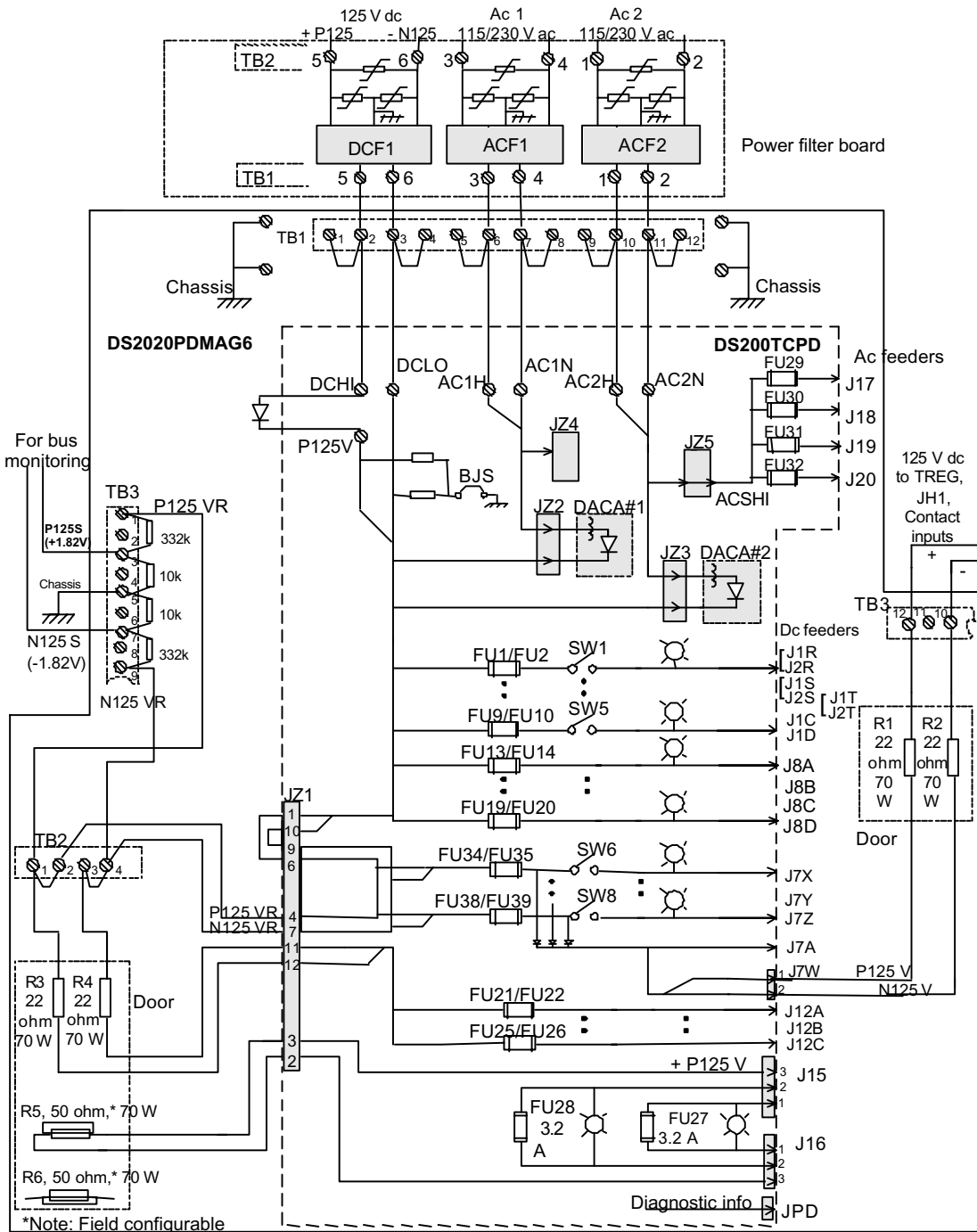
Distribution Module for I/O Cabinet

Diagnostic Monitoring

As shown in the following figure, the 125 V dc is reduced by a resistance divider network to signal level for monitoring. Other items monitored include the fuses in the feeders to the relay output boards. In the interface cabinet this diagnostic data is monitored by the VCMI; in the control cabinet it is cabled to the VDSK board and then to the VCMI.
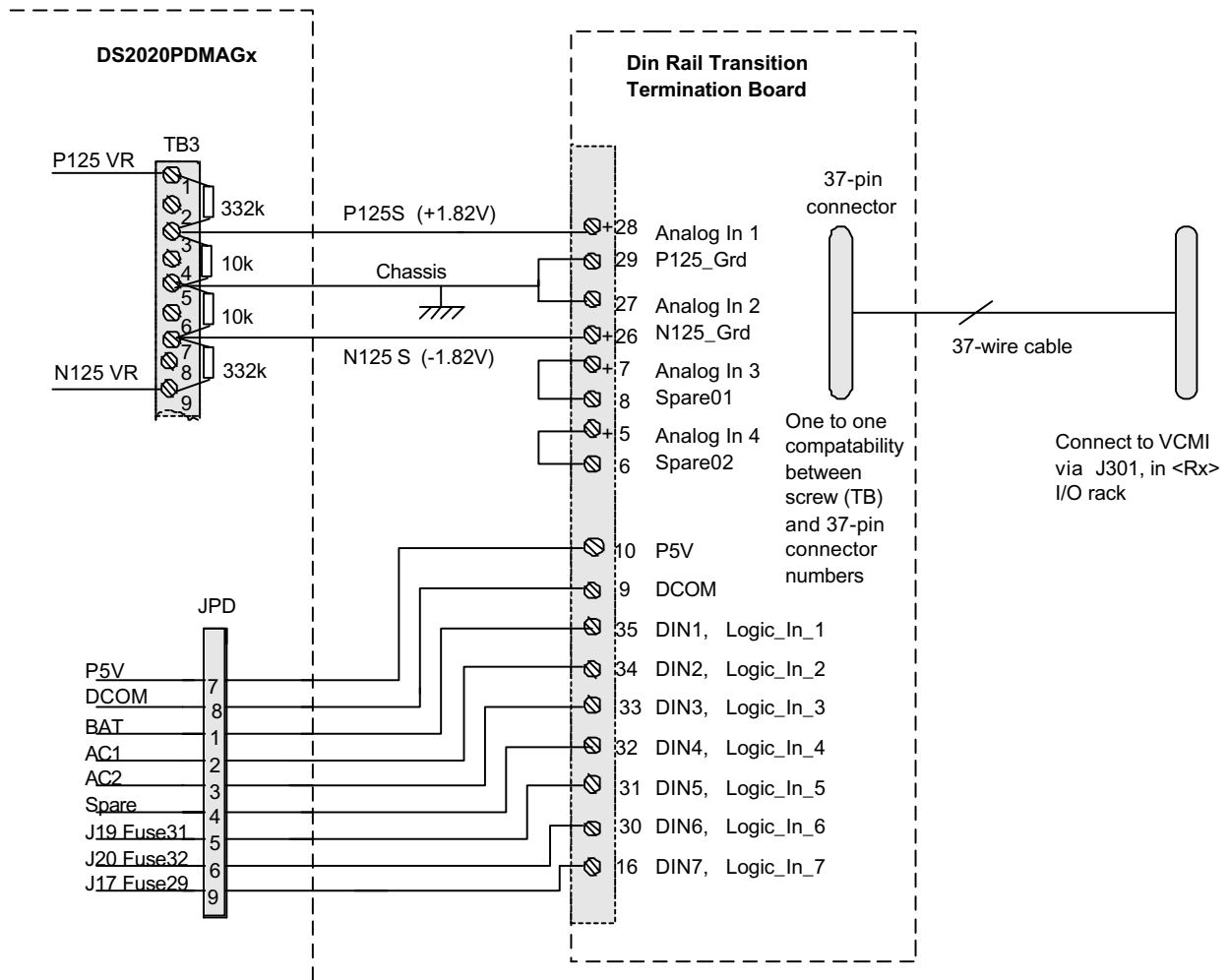
PDM Diagnostic Monitoring

Control Cabinet PDM

Power requirements for the control cabinet are less than for the interface cabinet. The PDM has the same layout but different fuse ratings, since only the control racks and relay output boards require power. For additional noise filtering for the controllers, Corcom power filters are included with the PDM.

125 V dc

Ac1 115/230 V ac

Ac2 115/230 V ac

To safety ground

IS2020CCPD

+P125 - N125   AC1H   AC1N   AC2H   AC2N

TB1 1   2   3   4   5   6

Chassis

MOV suppression

In+ Gnd In-   In+ Gnd In-   In+ Gnd In-

DCF1 120/250 V, 30 Amp   ACF1 120/250 V, 30 Amp   ACF2 120/250 V, 30 Amp

Power filters

Out+ Out-   Out+ Out-   Out+ Out-

DS200TCPD

Ac feeders to TRLY boards

DCHI DCLO   AC1H   AC1N   AC2H   AC2N
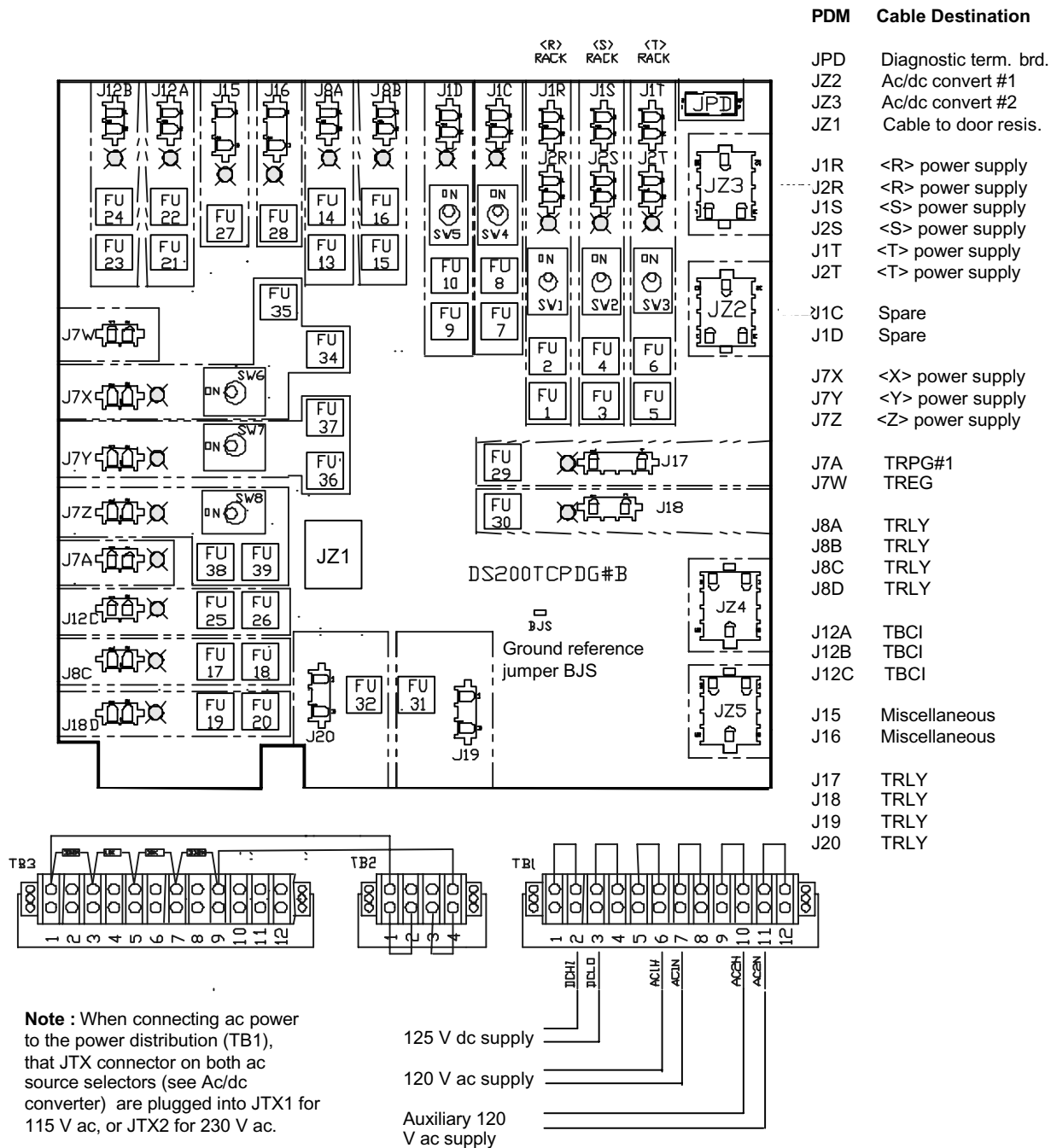
FU29 J17
FU30 J18
FU31 J19
FU32 J20

P125V

BJS

JZ4

JZ5

ACSHI

DACA#1

DACA#2

JZ2   JZ3

FU1/FU2 SW1   J1R
FU3/FU4 SW2   J1S
FU5/FU6 SW3   J1T

Dc feeders to controller racks
<R0>,<S0>,<T0>

DIN-rail transition terminal board

37- pin connector

P125 V   TB2   P125S (+1.82V)   28 Analog In 1
                                29 P125_Grd
          332k   27 Analog In 2
          10k   26 N125_Grd
                  N125 S (-1.82V) 7 Analog In 3
          10k   8 Spare 01
          Chassis   5 Analog In 4
          332k   6 Spare 02

N125 V   10 P5V
                                 9 DCOM

Cable to VCMI via VDSK on front of <R0> control rack.

One to one compatability between screw (TB) and 37-pin connector numbers.

Diagnostic information   JPD
P5V   7   35 DIN1, Logic_In_1
DCOM   8   34 DIN2, Logic_In_2
BAT   1   33 DIN3, Logic_In_3
AC1   2   32 DIN4, Logic_In_4
AC2   3   31 DIN5, Logic_In_5
Spare   4   30 DIN6, Logic_In_6
J19 Fuse31 5   16 DIN7, Logic_In_7
J20 Fuse32 6
J17 Fuse29 9

PDM for Controller Cabinet

Interface Cabinet PDM Installation

The cabling, wiring connections, and fuse locations for the PDM in the interface cabinet are shown in the following figure.

PDM	Cable Destination
JPD	Diagnostic term. brd.
JZ2	Ac/dc convert #1
JZ3	Ac/dc convert #2
JZ1	Cable to door resis.
J1R	<R> power supply
J2R	<R> power supply
J1S	<S> power supply
J2S	<S> power supply
J1T	<T> power supply
J2T	<T> power supply
J1C	Spare
J1D	Spare
J7X	<X> power supply
J7Y	<Y> power supply
J7Z	<Z> power supply
J7A	TRPG#1
J7W	TREG
J8A	TRLY
J8B	TRLY
J8C	TRLY
J8D	TRLY
J12A	TBCI
J12B	TBCI
J12C	TBCI
J15	Miscellaneous
J16	Miscellaneous
J17	TRLY
J18	TRLY
J19	TRLY
J20	TRLY

Note : When connecting ac power to the power distribution (TB1), that JTX connector on both ac source selectors (see Ac/dc converter) are plugged into JTX1 for 115 V ac, or JTX2 for 230 V ac.

125 V dc supply

120 V ac supply

Auxiliary 120 V ac supply

Interface Cabinet PDM Circuit Board

Fuses in Interface and Control Cabinet PDM

Values of the fuses for the PDM interface cabinet are shown in the following table.

Interface Cabinet PDM Fuse Ratings

PDM Fuse* No.	J Connector	Current Rating	Voltage Rating	Vendor Catalog No.
FU1−FU6	J1R, S, T	15 Amps	125 V	Bussman GMA-15A
FU7−FU10	J1C, D	5 Amps	125 V	Bussman GMA-5A
FU13−FU20	J8A, B, C, D	15 Amps	125 V	Bussman GMA-15A
FU21−FU26**	J12A, B, C	1.5 Amps	250 V	Bussman GMC-1.5A
FU27−FU28***	J15, 16	3.2 Amps	250 V	Bussman MDL-3.2A
FU29	J17	15 Amps	250 V	Bussman ABC-15A
FU30	J18	5 Amps	250 V	Bussman ABC-5A
FU31−FU32	J19, 20	15 Amps	250 V	Bussman ABC-15A
FU34−FU39	J7X, Y, Z	5 Amps	125 V	Bussman GMA-5A

*All fuses are ferrule type 5 mm x 20 mm, except for FU27-FU32 which are 0.25" x 1.25 ".
**The short circuit rating for FU21-FU26 is 100 Amps
***The short circuit rating for FU27-FU28 is 70 Amps

The PDM in the control cabinet (IS2020CCPD) does not supply power to any terminal boards except the TRLY boards. Values for the fuses in the control cabinet PDM are similar to those in the I/O cabinet PDM, except the rating for fuses FU1−FU6 is 5 Amps instead of 15 Amps.

Ground Reference Jumper

Jumper BJS is supplied for isolation of ground reference on systems with an external ground reference. The ground reference bridge across the 125 V dc power has two resistances, one on each side, and BJS connects the center to ground.

Note When more than one PDM is supplied from a common 125 V dc source, remove all the BJS connections except one.

GE Industrial Systems

Glossary of Terms

application code

Software that controls the machines or processes, specific to the application.

ARCNET

Attached Resource Computer Network. A LAN communications protocol developed by Datapoint Corporation. The physical (coax and chip) and datalink (token ring and board interface) layer of a 2.5 MHz communication network which serves as the basis for DLAN+. See DLAN+.

attributes

Information, such as location, visibility, and type of data that sets something apart from others. In signals, an attribute can be a field within a record.

Balance of Plant (BOP)

Plant equipment other than the turbine that needs to be controlled.

baud

A unit of data transmission. Baud rate is the number of bits per second transmitted.

Bently Nevada

A manufacturer of shaft vibration monitoring equipment.

BIOS

Basic input/output system. Performs the controller boot-up, which includes hardware self-tests and the file system loader. The BIOS is stored in EEPROM and is not loaded from the toolbox

bit

Binary Digit. The smallest unit of memory used to store only one piece of information with two states, such as One/Zero or On/Off. Data requiring more than two states, such as numerical values 000 to 999, requires multiple bits (see Word).

block

Instruction blocks contain basic control functions, which are connected together during configuration to form the required machine or process control. Blocks can perform math computations, sequencing, or continuous control. The toolbox receives a description of the blocks from the block libraries.

board

Printed wiring board.

Boolean

Digital statement that expresses a condition that is either True or False. In the toolbox, it is a data type for logical signals.

bus

An electrical path for transmitting and receiving data.

byte

A group of binary digits (bits); a measure of data flow when bytes per second.

CIMPLICITY

Operator interface software configurable for a wide variety of control applications.

COI

Computer Operator Interface that consists of a set of product and application specific operator displays running on a small panel pc hosting Embedded Windows NT.

COM port

Serial controller communication ports (two). COM1 is reserved for diagnostic information and the Serial Loader. COM2 is used for I/O communication

configure

To select specific options, either by setting the location of hardware jumpers or loading software parameters into memory.

CRC

Cyclic Redundancy Check, used to detect errors in Ethernet and other transmissions.

CT

Current Transformer, used to measure current in an ac power cable.

data server

A PC which gathers control data from input networks and makes the data available to PCs on output networks.

DCS (Distributed Control System)

Control system, usually applied to control of boilers and other process equipment.

DDPT

IS200DDPT Dynamic Pressure Transducer Terminal Board that is used in conjunction with the IS200VAMA VME Acoustic Monitoring Board that is used to monitor acoustic or pressure waves in the turbine combustion chamber.

dead band

A range of values in which the incoming signal can be altered without changing the output response.

device

A configurable component of a process control system.

DIN-rail

European standard mounting rail for electronic modules.

DLAN+

GE Industrial System's LAN protocol, using an ARCNET controller chip with modified ARCNET drivers. A communications link between exciters, drives, and controllers, featuring a maximum of 255 drops with transmissions at 2.5 MBPS.

DRAM

Dynamic Random Access Memory, used in microprocessor-based equipment.

EGD

Ethernet Global Data is a control network and protocol for the controller. Devices share data through EGD exchanges (pages).

EMI

Electro-magnetic interference; this can affect an electronic control system

Ethernet

LAN with a 10/100 M baud collision avoidance/collision detection system used to link one or more computers together. Basis for TCP/IP and I/O services layers that conform to the IEEE 802.3 standard, developed by Xerox, Digital, and Intel.

EVA

Early valve actuation, to protect against loss of synchronization.

event

A property of Status_S signals that causes a task to execute when the value of the signal changes.

EX2000 (Exciter)

GE generator exciter control; regulates the generator field current to control the generator output voltage.

EX2100 (Exciter)

Latest version of GE generator exciter control; regulates the generator field current to control the generator output voltage.

fanned input

An input to the termination board which is connected to all three TMR I/O boards.

fault code

A message from the controller to the HMI indicating a controller warning or failure.

firmware

The set of executable software that is stored in memory chips that hold their content without electrical power, such as EEPROM.

flash

A non-volatile programmable memory device.

forcing

Setting a live signal to a particular value, regardless of the value blockware or I/O is writing to that signal.

frame rate

Basic scheduling period of the controller encompassing one complete input-compute-output cycle for the controller. It is the system dependent scan rate.

function

The highest level of the blockware hierarky, and the entity that corresponds to a single .tre file.

gateway

A device that connects two dissimilar LAN or connects a LAN to a wide-area network (WAN), pc, or a mainframe. A gateway can perform protocol and bandwidth conversion.

Graphic Window

A subsystem of the toolboxfor viewing and setting the value of live signals.

health

A term that defines whether a signal is functioning as expected.

heartbeat

A signal emitted at regular intervals by software to demonstrate that it is still active.

hexadecimal (hex)

Base 16 numbering system using the digits 0-9 and letters A-F to represent the decimal numbers 0-15. Two hex digits represent 1 byte.

HMI

Human Machine Interface, usually a PC running CIMPLICITY software.

HRSG

Heat Recovery Steam Generator using exhaust from a gas turbine.

ICS

Integrated Control System. ICS combines various power plant controls into a single system.

IEEE

Institute of Electrical and Electronic Engineers. A United States-based society that develops standards.

initialize

To set values (addresses, counters, registers, and such) to a beginning value prior to the rest of processing.

Innovation Series Controller

A process and logic controller used for several types of GE industrial control systems.

I/O

Input/output interfaces that allow the flow of data into and out of a device

I/O drivers

Interface the controller with input/output devices, such as sensors, solenoid valves, and drives, using a choice of communication networks.

I/O mapping

Method for moving I/O points from one network type to another without needing an interposing application task.

IONet

The Mark VI I/O Ethernet communication network (controlled by the VCMIs)

insert

Adding an item either below or next to another item in a configuration, as it is viewed in the hierarchy of the Outline View of the toolbox.

instance

Update an item with a new definition.

item

A line of the hierarchy of the Outline view of the toolbox, which can be inserted, configured, and edited (such as Function or System Data)

IP Address

The address assigned to a device on an Ethernet communication network.

LCI Static Starter

This runs the generator as a motor to bring a gas turbine up to starting speed.

logical

A statement of a true sense, such as a Boolean

macro

A group of instruction blocks (and other macros) used to perform part of an application program. Macros can be saved and reused.

Mark VI Turbine controller

A version of the Innovation Series controller hosted in one or more VME racks that perform turbine-specific speed control, logic, and sequencing.

median

The middle value of three values; the median selector picks the value most likely to be closest to correct.

Modbus

A serial communication protocol developed by Modicon for use between PLCs and other computers.

module

A collection of tasks that have a defined scheduling period in the controller.

MTBFO

Mean Time Between Forced Outage, a measure of overall system reliability.

NEMA

National Electrical Manufacturers Association; a U.S. standards organization.

non-volatile

The memory specially designed to store information even when the power is off.

online

Online mode provides full CPU communications, allowing data to be both read and written. It is the state of the toolbox when it is communicating with the system for which it holds the configuration. Also, a download mode where the device is not stopped and then restarted.

pcode

A binary set of records created by the toolbox, which contain the controller application configuration code for a device. Pcode is stored in RAM and flash memory.

period

The time between execution scans for a module or task - also a property of a module that is the base period of all of the tasks in the module

pin

Block, macro, or module parameter that creates a signal used to make interconnections.

Plant Data Highway (PDH)

Ethernet communication network between the HMI Servers and the HMI Viewers and workstations

PLC

Programmable Logic Controller. Designed for discrete (logic) control of machinery. It also computes math (analog) function and performs regulatory control.

PLU

Power load unbalance, detects a load rejection condition which can cause overspeed.

Power Distribution Module (PDM)

The PDM distributes 125 V dc and 115 V ac to the VME racks and I/O termination boards.

PROFIBUS

An open fieldbus communication standard defined in international standard EN 50 170 and is supported in Simplex Mark VI systems.

Proximitor

Bently Nevada's proximity probes used for sensing shaft vibration.

PT

Potential Transformer, used for measuring voltage in a power cable.

QNX

A real time operating system used in the controller.

realtime

Immediate response, referring to process control and embedded control systems that must respond instantly to changing conditions.

reboot

To restart the controller or toolbox

RFI

Radio Frequency Interference is high frequency electromagnetic energy which can affect the system.

register page

A form of shared memory that is updated over a network - register pages can be created and instanced in the controller and posted to the SDB

resources

Also known as groups. Resources are systems (devices, machines, or work stations where work is performed) or areas where several tasks are carried out. Resource configuration plays an important role in the CIMPLICITY system by routing alarms to specific users and filtering the data users receive.

RPSM

IS2020RPSM Redundant Power Supply Module for VME racks that mounts on the side of the control rack instead of the power supply. The two power supplies that feed the RPSM are mounted remotely.

RTD

Resistance Temperature Device used for measuring temperature.

runtime

See product code.

runtime errors

Controller problems indicated on the front panel by coded flashing LEDS, and also in the Log View of the toolbox.

sampling rate

The rate at which process signal samples are obtained, measured in samples/second.

Serial Loader

Connects the controller to the toolbox PC using the RS-232C COM ports. The Serial Loader initializes the controller flash file system and sets its TCP/IP address to allow it to communicate with the toolbox over Ethernet.

Server

A pc which gathers data over Ethernet from plant devices, and makes the data available to PC-based operator interfaces known as viewers.

SIFT

Software Implemented Fault Tolerance, a technique for voting the three incoming I/O data sets to find and inhibit errors. Note that Mark VI also uses output hardware voting.

signal

The basic unit for variable information in the controller.

Simplex

Operation that requires only one set of control and I/O, and generally uses only one channel. The entire Mark VI control system can operate in Simplex mode, or individual VME boards in an otherwise TMR system can operate in Simplex mode.

stall detection

Detection of stall condition in a gas turbine compressor.

SOE

Sequence of Events, a high-speed record of contact closures taken during a plant upset to allow detailed analysis of the event.

Static Starter

See LCI.

symbols

Created by the toolbox and stored in the controller, the symbol table contains signal names and descriptions for diagnostic messages.

task

A group of blocks and macros scheduled for execution by the user.

TBAI

Analog input termination board, interfaces with VAIC.

TBAO

Analog output termination board, interfaces with VAOC.

TBCC

Thermocouple input termination board, interfaces with VTCC.

TBCI

Contact input termination board, interfaces with VCCC or VCRC.

TCP/IP

Communications protocols developed to inter-network dissimilar systems. It is a de facto UNIX standard, but is supported on almost all systems. TCP controls data transfer and IP provides the routing for functions, such as file transfer and e-mail.

TGEN

Generator termination board, interfaces with VGEN.

TMR

Triple Modular Redundancy. An operation that uses three identical sets of control and I/O (channels R, S, and T) and votes the results.

toolbox

A Windows-based software package used to configure the Mark VI controllers, also exciters and drives.

TPRO

Turbine protection termination board, interfaces with VPRO.

TPYR

Pyrometer termination board for blade temperature measurement, interfaces with VPYR.

TREG

Turbine emergency trip termination board, interfaces with VPRO.

trend

A time-based plot to show the history of values, similar to a recorder, available in the Historian and the toolbox.

TRLY

Relay output termination board, interfaces with VCCC or VCRC.

TRPG

Primary trip termination board, interfaces with VTUR.

TRTD

RTD input termination board, interfaces with VRTD.

TSVO

Servo termination board, interfaces with VSVO.

TTUR

Turbine termination board, interfaces with VTUR.

TVIB

Vibration termination board, interfaces with VVIB.

UCVB

A version of the Mark VI controller.

Unit Data Highway (UDH)

Connects the Mark VI controllers, LCI, EX2000, PLCs, and other GE provided equipment to the HMI Servers.

validate

Makes certain that toolbox items or devices do not contain errors, and verifies that the configuration is ready to be built into pcode.

VAMA

IS200VAMA VME Acoustic Monitoring Board that is used in conjunction with the IS200DDPT Dynamic Pressure Transducer Terminal Board to monitor acoustic or pressure waves in the turbine combustion chamber.

VCMI

The Mark VI VME communication board which links the I/O with the controllers.

VME board

All the Mark VI boards are hosted in Versa Module Eurocard (VME) racks.

VPRO

Mark VI Turbine Protection Module, arranged in a self contained TMR subsystem.

Windows NT

Advanced 32-bit operating system from Microsoft for 386-based PCs and above.

word

A unit of information composed of characters, bits, or bytes, that is treated as an entity and can be stored in one location. Also, a measurement of memory length, usually 4, 8, or 16-bits long.

Notes