ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

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New Information
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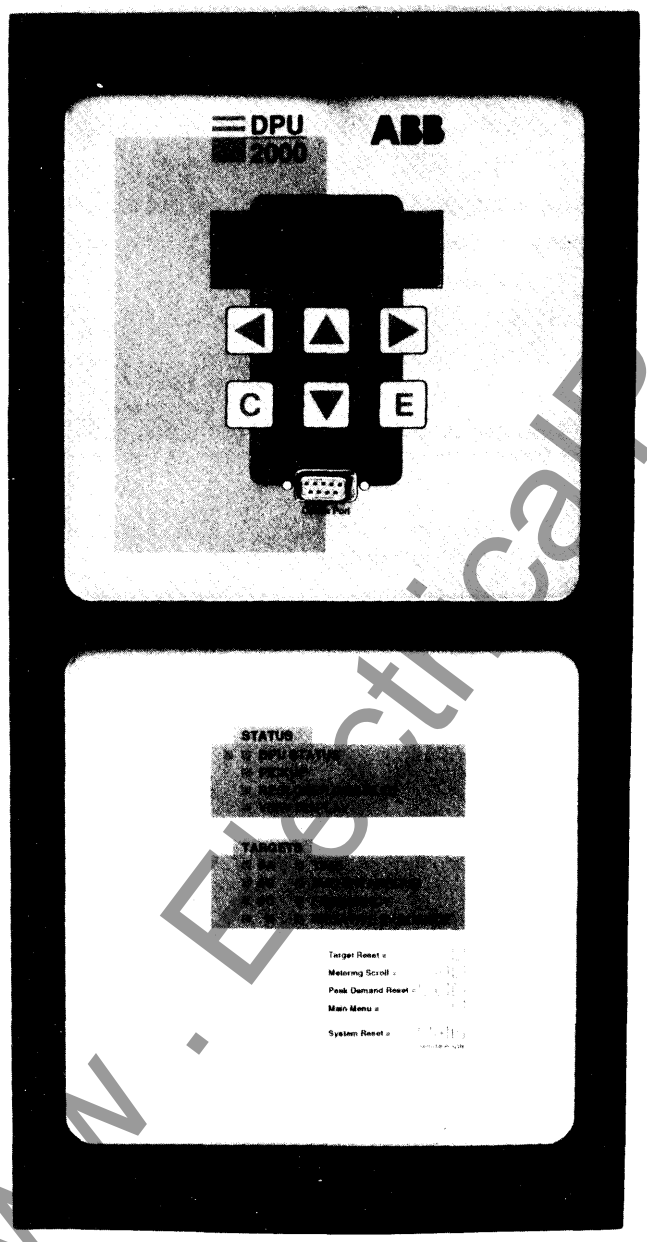
Distribution Protection Unit

DPU™ 2000



The Microprocessor Based Distribution Protection Unit-2000 (DPU-2000) is designed for application on electrical power distribution systems. Units are available for use with 5A or 1A secondary CT's and utilizes 69V, 120V or 208V Voltage Transformers.

The unit takes advantage of the power of the microprocessor and advanced algorithms to provide in one integrated package the following protection and monitoring functions:

Features

- Three Phase Overcurrent Protection (Time and Instantaneous): 51P, 50P-1, 50P-2, 50P-3
- Ground Overcurrent Protection (Time and Instantaneous): 51N, 50N-1, 50N-2, 50N-3
- Negative Sequence Overcurrent Protection: 46
- Multi-Shot Reclosing: 79M
- Phase and Ground Directional Overcurrent Protection: 67P/67N
- Frequency Load Shed and Restoration: 81 (2-Steps)
- Undervoltage Control/Alarm and Overvoltage Alarm: 27/59
- Distance to the Fault in Miles
- Metering: Currents, Voltages, Watts, Vars, kWh, kVarh, Power Factor and Frequency
- Peak Demand Amperes, Watts and Vars with Time Stamp
- Fault Summary and Detailed Fault Records: Last 32 Trips
- Operations Record: Last 128 Operations
- Accumulation of Breaker Interrupting Duty
- Continuous Self-Testing
- Three Selectable Setting Tables: Primary, Alt. 1 and Alt. 2
- 16 Contact Inputs and 11 Output Contacts
- Counters: Overcurrent Trips, Breaker Operations and Reclosures
- Continuous Self Checking of Power Supply Voltages, Memory Elements and Digital Signal Processor
- Breaker Failure Detection Adjustable from 5 to 60 cycles

Additional Features

- Front Mounted Man Machine Interface (MMI) Provides Continuous Real Time Display of Current and Voltage Magnitudes
- Programmable Output Contacts (8) and Contact Inputs (13) Provide Flexibility When Designing Adaptive Relaying Schemes
- Front and Rear Comm. Ports Allow Local or Remote Data Acquisition and Verification and Editing of Relay Settings
- Test Mode Allows Testing of Overcurrent Functions and Reclose Sequence Without Simulating Breaker Operation
- Horizontal or Vertical Drawout DPU-2000's are Furnished with Automatic CT Shorting and Sequenced Disconnects
- Nine Time Overcurrent Characteristic Curves Including Extremely Inverse, Very Inverse, Inverse, Short Time Inverse, Definite Time, Long Time Extremely Inverse, Long Time Very Inverse, Long Time Inverse and Recloser Curve.
- Five Instantaneous (50P/N-1) Characteristic Curves Including Standard Instantaneous, Inverse Instantaneous, Definite Time, Short Time Inverse and Short Time Extremely Inverse.
- Pre-programmed Adaptive Relay Schemes Include Zone Sequence Coordination, Cold Load Pickup Detection and Automatic Blocking of the Reclose Function when Manually Closing Into a Fault
- Optional Load Profile Feature Records Per Phase Voltage, Watts and Vars for 40 days at 15 Minute Intervals
- Optional User Programmable Curves (3) and Oscillographic Data Storage Capability (Last 8 Events)

Protective Functions:

Time Overcurrent Functions: 51 (Phase and Ground)
- Curve: Nine Time Overcurrent Characteristic Curves
- Pickup: 1 to 12A in 0.1 A Steps or 0.2 to 2.4A in 0.02A Steps
- Time Dial Selections: 1 to 10 in 0.1 Steps
- Time Delay Selections: 0 to 9.9s in 0.1 Steps

Instantaneous Overcurrent Function: 50

3-Individual 50 Phase and Ground:
- 50P-1 and 50N-1
  - Curve: Five Time Overcurrent Characteristic Curves
  - Pickup: 0.5 to 20 * (51 Setting)
  - Time Dial Selections: 1 to 10 in 0.1 Steps
- 50P-2 and 50N-2 Time Delay: 0 to 9.99s in 0.01s Steps
- 50P-3 and 50N-3 Instantaneous

Reclosing Features: 79 M
- Reset Time: 3 to 200s.
- Open Interval Time: 0.1 to 200s.
- Number of Reclosures: 0 to 4
- Number of Instantaneous Trips: 0 to 4

Phase Balance Negative Sequence: 46
- Curve: Nine Time Overcurrent Characteristic Curves
- Pickup: 1 to 12A in 0.1 A Steps or 0.2 to 2.4A in 0.02A Steps
- Time Dial Selections: 1 to 10 in 0.1 Steps
- Time Delay Selections: 0 to 9.9s in 0.1 Steps

Directional Overcurrent: 67 (Phase and Ground)
- Curve: Nine Time Overcurrent Characteristic Curves
- Pickup: 1 to 12A in 0.1 A Steps or 0.2 to 2.4A in 0.02A Steps
- Time Dial Selections: 1 to 10 in 0.1 Steps
- Time Delay Selections: 0 to 9.9s in 0.1 Steps
- Pos. Seq. Torque Angle: 0 to 90 deg.
- Neg. Seq. Torque Angle: 90 to 180 deg.

Frequency: 81
- Load Shed Pickup: 56 to 60Hz or 46 to 54Hz in Steps of 0.01
- Shed Time Delay: 0.08 to 9.98 seconds in Steps of 0.02
- Load Restoration: 56 to 64Hz or 46 to 54Hz in Steps of 0.01
- Restoration T.D.: 1 to 999 seconds in Steps of 1
- Voltage Block: 40 to 200 V in Steps of 1

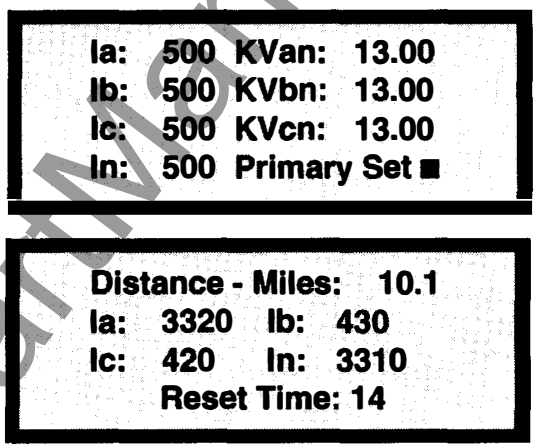
UnderVoltage: 27
- Pickup: 40 to 200 V in Steps of 1
- Time Delay: 0 to 60 seconds in Steps of 1

OverVoltage: 59
- Pickup: 70 to 250 V in Steps of 1
- Time Delay: 0 to 60 seconds in Steps of 1

Man Machine (MMI) Interface:

The MMI consists of a 4 row by 20 character backlit display and a six button panel. During normal operation, the MMI continuously displays four current and three voltage magnitudes. When a fault occurs, the MMI displays the distance to the fault and the four current magnitudes at the time of the fault until the targets are reset. During the reclose sequence, the time remaining in the open interval or reset time period is also displayed. Relay Settings, Metering, Fault and Operations Records, and a Test Mode can be accessed directly from the MMI or via the front RS-232 Communications Port.

MMI Displays



Metering:

The metering function provides the following electrical parameters for Wye and Delta connected systems.

- Phase Currents IA, IB and IC: Amperes and Degrees
- Ground Current IN: Amperes and Degrees
- Phase Voltage kVan, kVbn and kVcn: Mag. and Degrees for Wye VT's
- Phase Voltage kVab, kVbc and kVca: Mag. and Degrees for Delta VT's
- Kilowatts per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- Kilovars per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- Power Factor for Wye VT's
- kWh per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- kVarh per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- Demand and Peak Demand Currents per phase (Time Constant of 5, 15, 30 or 60 minutes)
- Time Stamp for Peak Demand Currents
- Demand and Peak Demand kW per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- Time Stamp for Peak Demand kW
- Demand and Peak Demand kVar per phase; 3 phase for Wye VT's and 3 phase for Delta VT's
- Time Stamp for Peak Demand kVar

Binary (Contact) Inputs:
Permanently programmed contact inputs include the 52a and 52b breaker auxiliary contacts and the 43A recloser contact.

(13) User programmable contact inputs include:
- Monitoring of the trip coil circuit and spring charging contact.
- Enabling phase and ground torque control, two unique alternate settings tables, three unique instantaneous functions, and the zone sequence coordination scheme.
- Initiating single or multi-shot reclosing, a close or open operation, and an event or waveform capture.

Output Contacts:
Permanently programmed output contacts include the Trip and Close Contacts and the Self-Check Alarm.

(8) User programmable output contacts can be programmed to indicate the following conditions:
- Breaker Failure
- Recloser Lockout
- Recloser Disabled
- 50-1 Function Disabled
- Phase/Ground Pickup
- Freq. Load Shed Trip
- Overvoltage
- Low Power Factor Alarm
- Accumulated KSI Alarm
- Phase Demand Alarm
- Blown Fuse Alarm
- And More
- Trip Coil Failure
- Tap Changer Cutout
- Zone Seq. Coord. Enabled
- 50-2 Function Disabled
- Phase A, B or C Trip
- Freq. Load Rest. Closure
- Undervoltage
- High Power Factor Alarm
- Recloser Counter Alarm
- Neutral Demand Alarm
- Overcurrent Counter

Trip Alarms
- **51P** Phase Time
- **51N** Ground Time
- **50N-1** Ground Inst.
- **50N-2** Ground Inst.
- **50N-3** Ground Inst.
- **46** Negative Sequence
- **50P-1** Phase Instant.
- **50P-2** Phase Instant.
- **50P-3** Phase Instant.
- **67P** Positive Seq. Directional
- **67N** Negative Seq. Directional

Communication Ports:
The DPU 2000 provides the capability of remote communication via a serial port communications link. A standard RS-232-C serial port connector (9 pin) is located on the front of all DPU-2000's and an optional RS-232 (9 pin), RS-485 (2 wire) or an INCOM (2 wire) connector can be provided in the rear. The available baud rates can be set for 300, 1200, 2400, 4800 or 9600. Furnished with the optional rear communications port is an **IRIG-B** Input for precision real time setting.

Fault Summary
A summary of the last 32 faults is provided.
The fault summary includes the fault number, recloser sequence number, date and time, tripping element, and the phase and neutral currents.

Fault Record
The fault record contains the last 32 faults. The fault record displays one fault at a time and includes the following information: fault number, reclose sequence number and enabled settings table, date and time, tripping element, apparent distance to the fault in miles, phase and neutral currents (magnitude and angle), positive and negative and zero sequence currents, phase voltages, positive and negative sequence voltages, relay operate time and breaker operate time.

Operations Summary
The operations summary includes the total number of breaker operations, total number of overcurrent trips, breaker interruption duty per phase, total number of reclosures and the number of successful reclosures by sequence number: 1st, 2nd, 3rd, and 4th.

Operations Record
An operations record contains the last 128 operations. The operations record includes the operation number, date and time and description of the operation. Operations include manual opening and closing of the breaker, activation of contact inputs and output contacts, alarm conditions, TEST MODE data, Editor access and zone sequence coordination stepping.

Self-Check Status
The system provides continuous self-testing of its power supply voltages, memory elements, the digital signal processor, and the execution of its program. In the event of a system failure, the protective functions are disabled and the self-check alarm contacts are actuated.

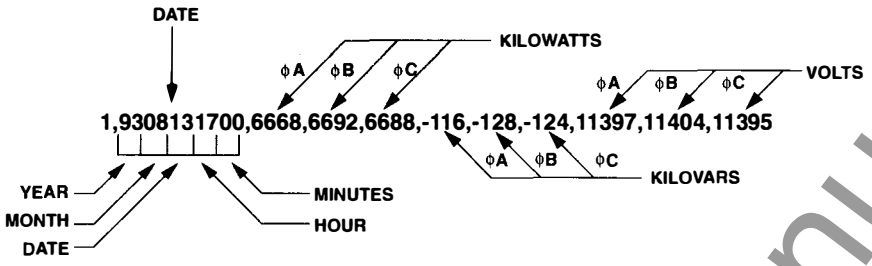
Contact Input Status
The contact input menu displays the open/close status of all permanently programmed and User programmed contact inputs.

Output Relay Test
The output contact test mode allows activation of all permanently programmed and User programmed output contacts via the man-machine interface or the communications port.

Functional Test Mode
Allows testing of programmed overcurrent functions and reclose sequence (upon removal of test current) without simulating operation of the 52a and 52b contact inputs. The DPU-2000 will stay in the functional TEST MODE for fifteen minutes or until it is exited.

Optional Load Profile:

An optional load profile feature records per phase voltage, watts and vars for 40 days at 15 minute intervals. A five (5), thirty (30) or sixty (60) minute time interval (demand constant) can also be selected for which the load profile record will then contain 13.3, 80 or 160 days of information, respectively. The load profile feature requires wye connected VT's in order to accurately measure unbalanced loads. The load profile data is only retrievable through the External Communications Program and the communications port.



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1,9308131745,6668,6692,6688,-116,-128,-124,11400,11404,11398

Ratings And Tolerances

Analog Input Circuits:

- 5A Input Rating, 16A Continuous and 450A for 1second
- 1A Input Rating, 3A Continuous and 100A for 1second
- Input Burden Less than 0.05VA @ 5A
- Voltage Rating 260V Continuous and 480V for 10 second
- Frequency 50 or 60 Hz

Contact Input Circuits (Input Burden):

- 0.44 VA for 125 VDC, 110 VDC, and 120 VAC models
- 0.16 VA for 48 VDC models
- 0.3 VA for 24 VDC models

Control Power Requirements:

- 125 VDC @ 0.16A max., range 70 to 150 VDC
- 120 VAC @ 0.17A max., range 100 to 140 VAC
- 110 VDC @ 0.17A max., range 70 to 140 VDC
- 48 VDC @ 0.35A max., range 28 to 58 VDC
- 24 VDC @ 0.70A max., range 18 to 30 VDC

Operating Temperature: -20 to +70 degrees C

Output Contacts @ 125 Vdc:

- 30A Tripping
- 1A Break Resistive
- 5A Continuous
- 0.3A Break Inductive

Transient Immunity:

More than 3000V, 1MHz bursts at 60Hz repetition rate, (ANSI C37.90a SWC); Fast Transient Test, EMI Test

Dielectric: 2125 Vdc, 1 second, all circuits to ground.

Weight: Unboxed 18.5 lbs (8.4 kg)
Boxed 21.5 lbs (9.7 kg)

Volume: 1.31 Cubic Feet

Note: For more information see I.B.-7.11.1.7-2

Uninterruptible Power Supply (Battery Backup Unit)

UPS

The UPS may be used as an alternate source to provide dependable backup power only to a 24-volt dc DPU. Ordering information and functional characteristics for the UPS are listed below.

NiCd Battery Pack

Battery Type	Nickel Cadmium (NiCd), high temperature cells	
Output	24 Vdc	
Size	Twenty "D" cells, 1.2 V per cell	
Capacity	4.3 A-hrs	
Temperature Ranges:	Storage	–40deg C to 70deg C
	Discharge	–20deg C to 70deg C
	Charge (standard)	0deg C to 70deg C

Ordering Information
(For more information see I.B. 7.12.1.7-9)

Catalog Number	Description
270B0024	= UPS charger, NiCd battery pack (20 "D" cells) and the battery support tray.
270B0024-LB	= UPS charger and the battery support tray.
612024-T2	= Only the NiCd battery pack (20 "D" cells).
270B0024-LT	= UPS less tray.

Case Dimensions (Vertical and Horizontal)

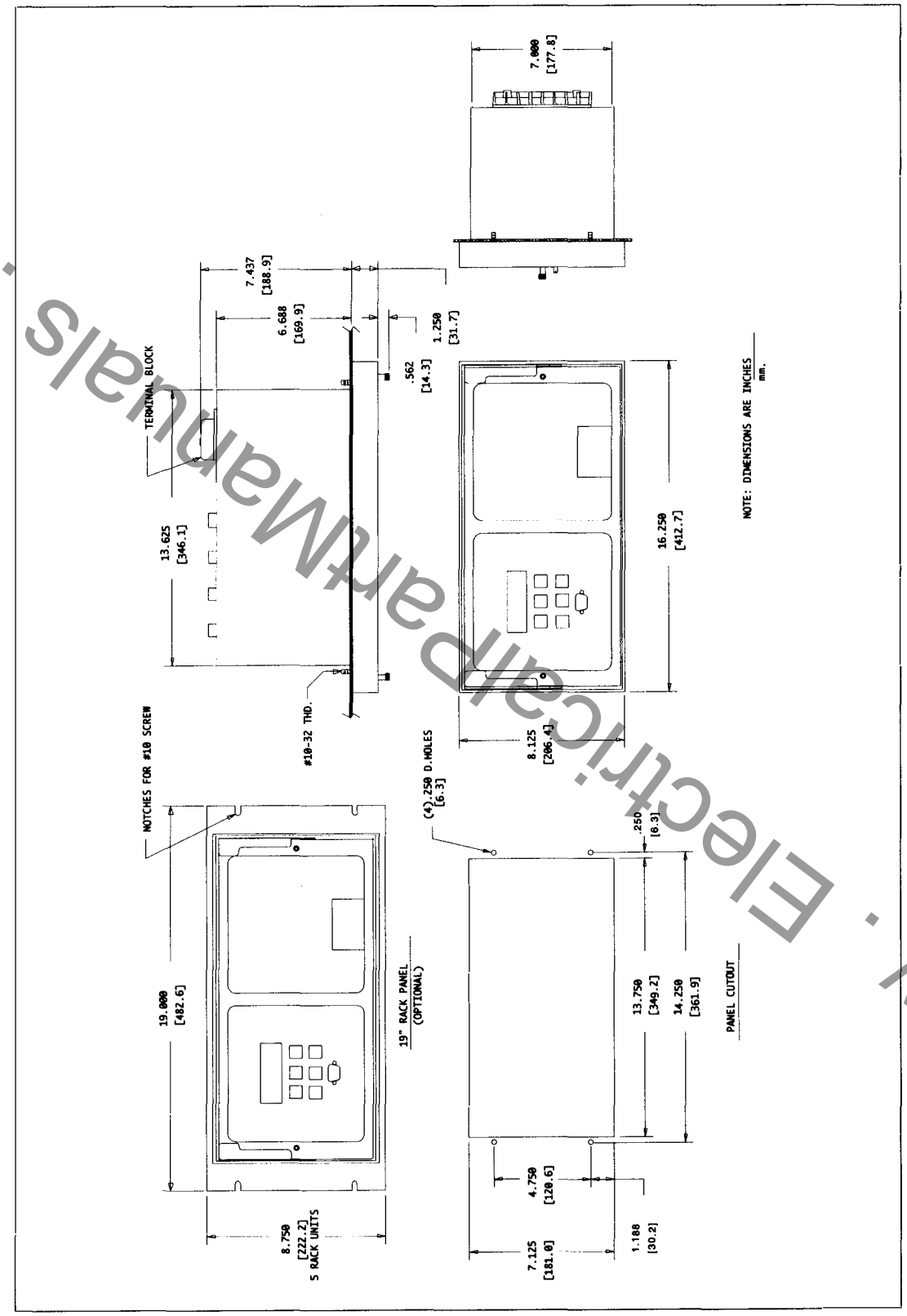

Figure 1

External Connection Diagram

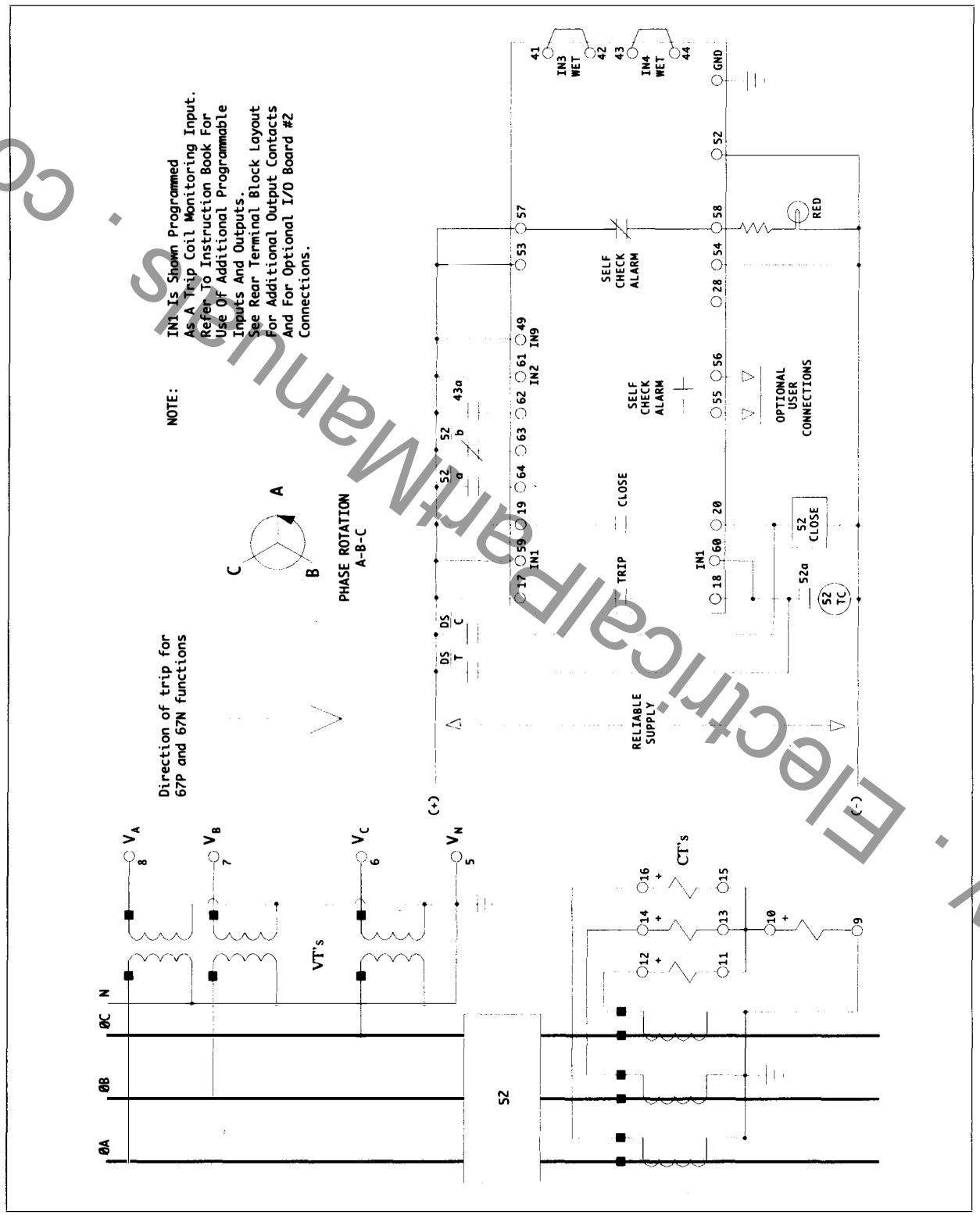

Figure 2

Rear Terminal Connection Diagram
Vertical Mounting Shown, Horizontal Also Available

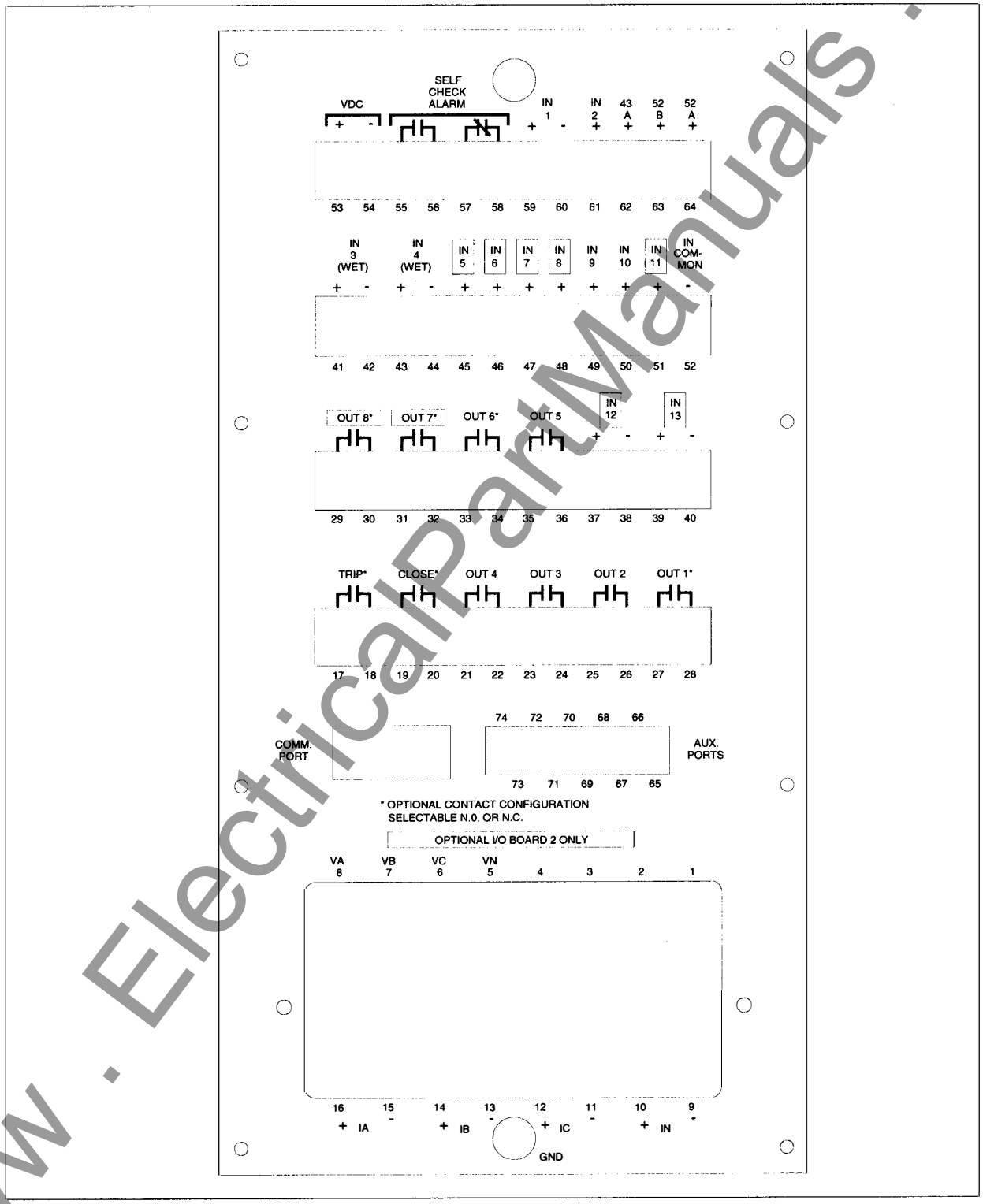

Figure 3

DPU 2000 Ordering Selections

	48	A	M	R	X	D	C	Z–	SSS
Four Analog Inputs (I only)		4							
Seven Analog Inputs (I and V)		7							
Vertical Mounting			V						
Horizontal Mounting			H						
Current Range Phase / Ground									
1.0-12A / 1.0-12A				0					
1.0-12A / 0.2-2.4A				1					
0.2-2.4A / 0.2-2.4A				2					
Control Voltage									
110 Vdc					0				
48 Vdc					3				
125 Vdc					4				
120 Vac					6				
24 Vdc					9				
Digital I/O Inputs / Outputs									
9 / 9						0			
16 / 11						1			
Rear Communications Port									
RS-232							1		
Aux Comm Port and RS-232							2		
INCOM®*							3		
Aux Comm Port and INCOM®*							4		
RS-485							5		
Frequency									
50 Hertz								5	
60 Hertz								6	
Special software is available for the following applications:									
Software									
Standard									000
Load Profiles									001
Customer Programmable Curves									010
Oscillographic Data									100
All Special Software Features									111

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