

Multilin™ D25

Substation Controller Substation Automation and Control in one Box

GE's D25 is a scalable, flexible, modular, and upgradable automation controller, suitable for both large and small substation automation projects in either new or retrofit situations. The D25 provides the tools and flexibility necessary to create customized automation and control applications including; communications & data concentrator, automation controller, metering & sequence of events fault recording, and transformer monitoring & control.

Key Benefits

- Replaces multiple devices with a single unit. It's unified design reduces wiring and maintenance costs
- Retrieves data from legacy and third-party devices and runs diagnostics of primary equipment expanding future physical and functional station requirements
- It can be equipped with two different built-in screens 1). Data Display Panel to show status of different points (digital or analog) to the operator and 2). Graphical Display Panel (GDP) allowing users to configure dynamic displays with one-line diagrams and alarm screens
- Measures and records total harmonic distortion, harmonic spectrum, RMS trending, RMS profiling, voltage sags, swells and interruptions, allowing operators and analysts to examine the consistency of power going through the system and pinpoint problem area
- Transfers fault records automatically via a LAN to the substation computer or directly to a remote PC through email ensuring relay settings are correct

Applications

- Transmission substations – runs applications including interlocking, advanced load shedding, and fault recording via IEC® 61850 GOOSE through a dual redundant Ethernet
- Distribution substations – handles all the automation
- Generator substations – monitors and automates large set-up transformers and integrates transformer sensor data within existing SCADA systems



Automation and Control

- Provides synchronism check including bypass function
- Monitors voltage difference, phase angle difference, and slip frequency
- Supports multiple buses per feeder allowing for dual-busbar schemes
- Auto restoration accommodating up to 255 concurrent restorations
- Built in LogicLinx®, an IEC 61850 compliant editing/debugging tool
- Extensive, configurable alarming capability for AC analog values

Power Quality Metering

- Records oscillography files including 1, 2, 2 ½, and 3 element metering
- Digital fault recording up to 16 MB of fault data locally
- Harmonic values (up to the 21st) on every AC Analog input
- Monitors power quality profile RMS values for up to 6 AC circuits
- Fully functional local HMI
- Records AC analog values and stores them in COMTRADE format

Flexible I/O

- Modular system allows an easy increase in I/O capability
- Accommodates up to 96 digital inputs, 32 digital outputs, 32 analog inputs (DC) and 15 AC inputs
- Monitors and records all I/O at a 1 ms resolution



Substation Automation Controller

GE's D25 is a flexible, modular, and compact RTU, suitable for both large and small substation automation projects. Designed to act as a local data concentrator with its capabilities to communicate in more than 120 different SCADA protocols including IEC 61850. Along with a set of flexible, expandable and customizable I/O including A/C inputs, GE's D25 can fulfill the role of a complete bay level controller RTU. The D25 provides advanced tools and the flexibility necessary for applications such as load shedding, digital fault recording, power quality monitoring, metering, transformer monitoring & control, or custom PLC logic.

The D25 provides the tools and flexibility necessary to create customized automation control applications including

- Communications & data concentrator
- Automation controller
- Metering, sequence of events & fault recording
- Transformer monitoring & control

Communications and Data Concentrator

Protocol Conversion

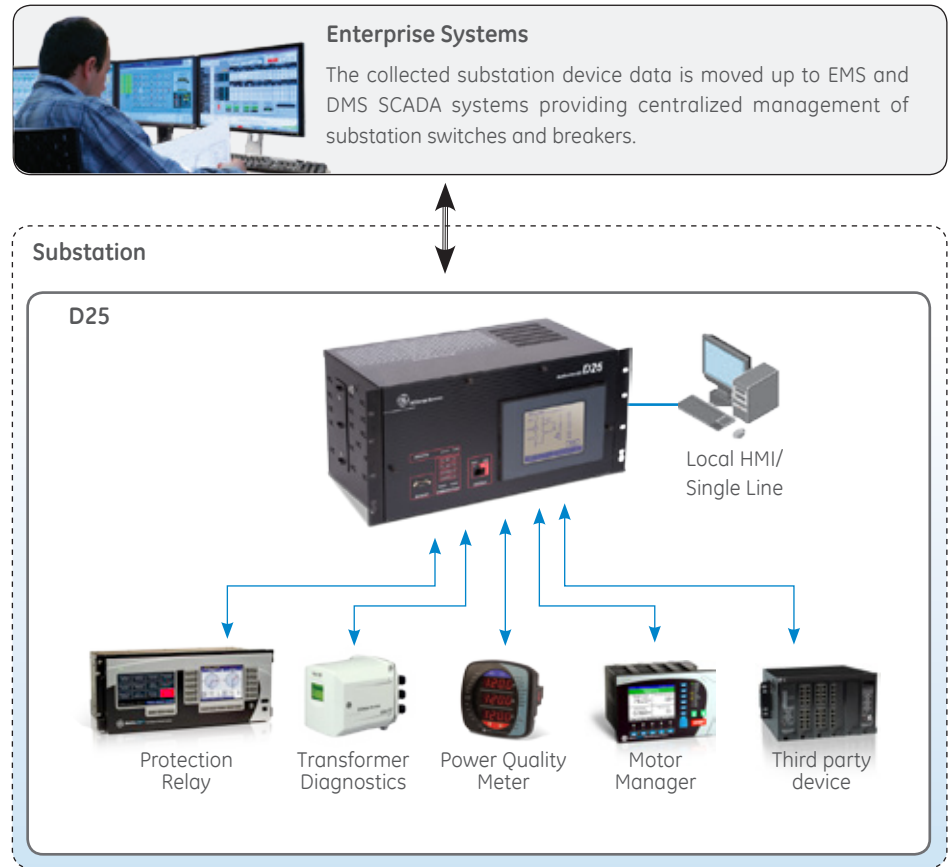
With a communications suite that supports over 120 protocols, including IEC® 61850, Modbus®, DNP, SPABus, Courier, and IEC 101/103/104, the D25 supports the translation of multiple protocols over multiple communication ports enabling easy integration of new and existing devices into supervisory and control systems (SCADA).

Flexible IEC 61850

The D25 IEC 61850 server application allows data from the unit to be modeled and presented as IEC 61850 Logical Node data. The data can come from any of the D25's internal applications or from devices connected using supported communication protocols. This powerful conversion tool allows data from non-IEC61850 devices to be modeled into 61850 data for transmission upstream, eliminating the need to replace older or legacy devices for IEC 61850 compliance.

KEMA® certified as a IEC 61850 compliant device, the D25 includes additional IEC 61850 features such as Security Controls and Buffered Control Blocks, which do not exist in most bay-level equipment.

D25 Communications



With native support for IEC 61850 GOOSE, the D25 provides Peer-to-Peer communications between D25s and other GOOSE enabled devices in the system. GE's D25 supports both fixed and configurable GOOSE messaging (data sets), ensuring connectivity to a wide range of protection devices including the Multilin UR & URPlus Families of protection & control devices. GE's D25 meets IEC 61850 Class P2/3 performances levels required for timely interlocking schemes.

Local Remote Unit (LRU)

Local Remote Unit (LRU) allows the D25 device to abstract a portion of its database and make it available to selected master stations, with the D25 presented as multiple slave devices. The same concept applies to slave devices (or servers), where the D25 can act as multiple master stations and retrieve data as needed. The flexibility and LRU concept allow the D25 to act as a gateway and data concentrator.

Ethernet-ready

The D25 supports standard communication methods over Ethernet, including Telnet and TFTP, but more importantly GE's D25 units can also extend your LAN to legacy devices by providing a virtual connection to devices that do not have Ethernet capability, enabling you to perform remote configuration changes over a Ethernet network.

Advanced Automation & Control

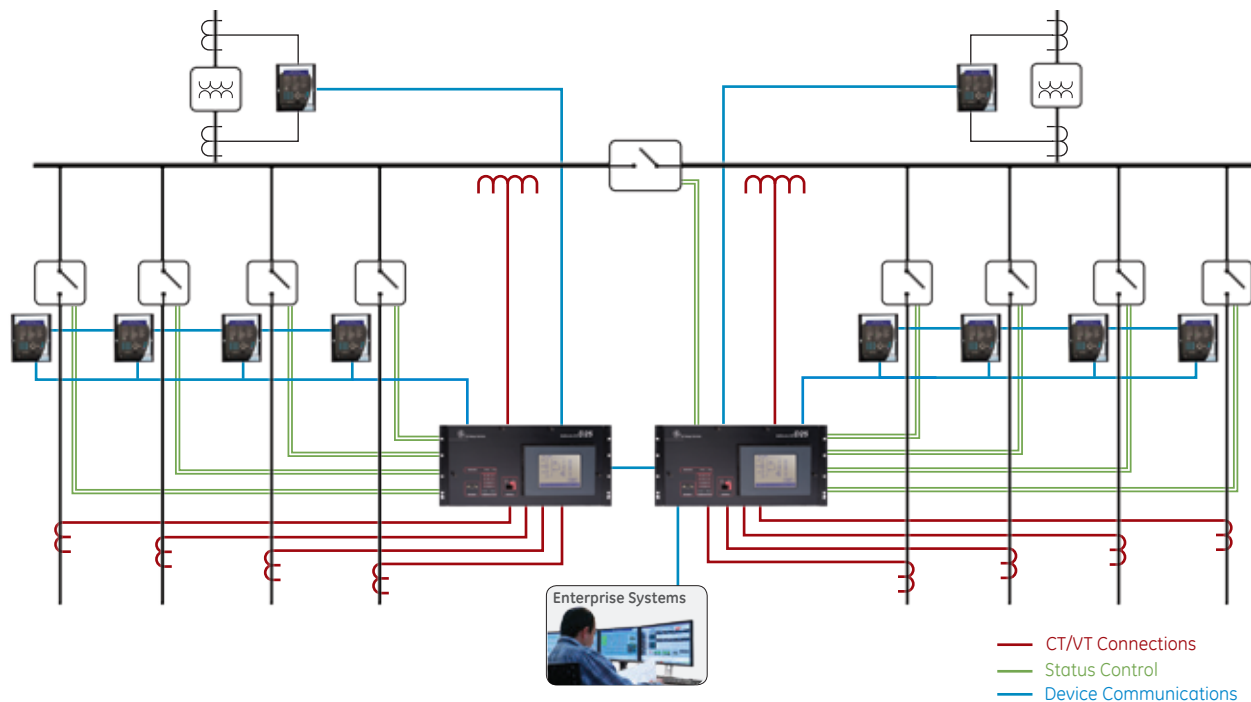
Synchronism Check

The D25 supports the Synchcheck functions, including a synchronism bypass function for any or all of the following conditions:

- Dead Line – Live Bus
- Dead Bus – Live Line
- Dead Bus – Dead Line

The D25 monitors the voltage difference, phase angle difference, and slip frequency to ensure proper breaker closure per specific user-defined settings.

Flexible Substation Communications & Control



Dynamic Bus Switching

The D25 supports multiple buses per feeder, where each bus is defined by a set of PTs and a digital input (referred to as Active Bus Indication) that indicates when the bus is active on that feeder. The D25 monitors the Active Bus Indications to determine which set of PTs to use for the feeder. This unique ability allows for dual-busbar schemes to be reconfigured dynamically, maintaining a system-metering scheme without requiring an external voltage selection scheme.

Auto Restoration

Focused on improving power system reliability, the D25 enables advanced auto restoration schemes. Applicable to groups of two feeders joined by a Tie Switch with each having one breaker and up to three feeder switches, the D25 can accommodate up to 255 concurrent restorations with separate definitions on each feeder. This application makes the D25 a powerful auto-restoration device that is fully flexible and customizable.

Load Shedding

The D25 can be equipped with a robust and configurable load shedding algorithm. The application monitors digital input states and digital output requests related with zones and groups in order to automatically control selected

feeders, optimizing system loading for improved system reliability and asset life. All application timing and other configuration parameters are customizable and can be changed online.

Mathematical Control Logic

Using the Calculator tool, users can create advanced solutions that group, manage and control points to produce the required automation results.

The calculator tool can perform mathematical, logical, or timer based operations on any data points stored in the D25. Using a graphical interface, users can define logical expressions using mathematical functions such as addition, multiplication, logarithm, greater than, less than, as well as other boolean functions.

Programmable Logic (LogicLinx™)

For more advanced applications, GE's programmable logic (LogicLinx) software provides PLC functionality on the D25 platform. LogicLinx offers textual and graphical languages as defined in the IEC 61131-3 standard for PLC programming environments, including Sequential Functions Chart, Instruction List, Structured Text, Ladder Diagram, and Function Block Diagram. In addition, a wide range of arithmetic, Boolean and logical operations are supported.

AC Analog Alarming

When deployed in advanced AC Monitoring applications, the D25 provides extensive and configurable alarming capability for AC analog values such as configurable hysteresis parameters.

Metering, Sequence of Events & Fault Recording

With a high-density of communication channels, analog, and digital I/O modules, the D25 provides real-time data acquisition and recording functions. The D25 is capable of recording oscillography files and performing 1, 2, 2 ½, and 3-element metering on separate or bussed feeders, up to a maximum of four three-phase feeders delivering system visibility for utility operators and maintenance staff

Sequence of Events

The D25 manages and preserves all events and original I/O time tags, with 1 ms accuracy, using a state-of-the-art database. Data accuracy is critical to ensure accurate and reliable fault analysis, to enable a more stable power system through positive corrective actions.

Digital Fault Recording

When activated by user-configurable trigger conditions, the D25 Digital Fault Recording

software captures current and voltage waveforms as well as status from analog and digital channels. Up to 250 digital status inputs can be recorded and combined with 240 cycles of waveform data in standard COMTRADE files. The software stores up to 16 MB of fault data locally for subsequent retrieval via multiple protocols such as TFTP or DNP3.

Harmonic Spectrum

The D25 can provide harmonic values (up to the 21st) on every AC Analog input and make it available to a control center. Values such as total harmonic distortion are also calculated and made available.

Power Quality

The D25 can monitor power quality and profile RMS values for up to 5 separate AC circuits. It has the ability to detect and report short-duration and extended-duration voltage swells, sags, harmonics, harmonic distortion, and interruptions and also records the RMS voltage profiles of those events as COMTRADE format files for simplified power system analysis and troubleshooting

Graphical Display Panel (HMI)

This easy-to-use touch screen panel can be configured as a fully functional local HMI with features such as interlocking, password control, metering, and SOE / alarm annunciator screens. Individual screens in the graphical display can be customized to meet the unique requirements for each application.

AC Profiling

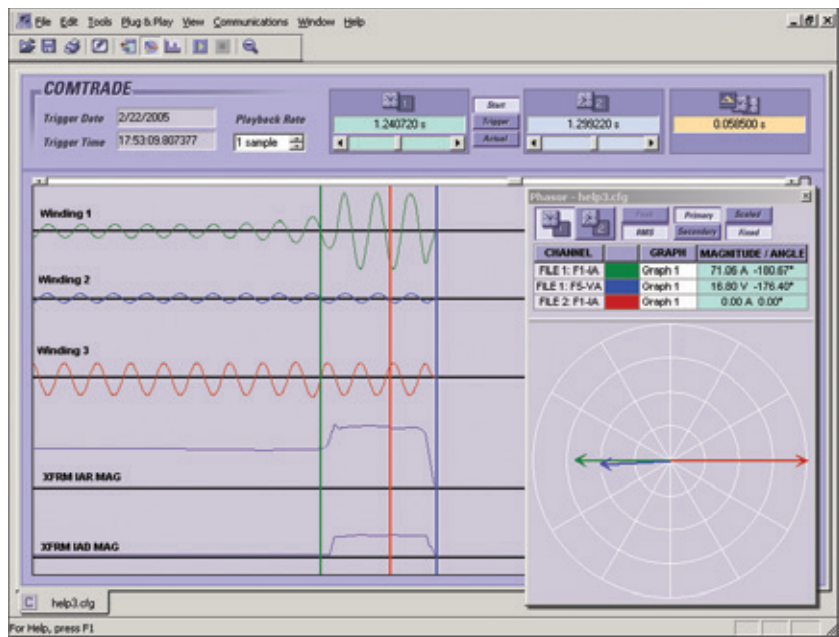
Record any AC analog value and store it in COMTRADE format. Record definitions can be customized for almost any scenario and can be triggered by a digital input. Data can be captured for as long as 5400 cycles, providing a complete, accurate view of the system.

Transformer Monitoring

The D25 utilized in Transformer Monitoring applications is a condition analysis and management system for critical power transformers. This system measures key transformer data, implements continuous on-line analysis models, and communicates critical information through the communication options supported by the D25.

On-line analysis models include:

- Load Current Model
- Cooling System Efficiency Model



Transformer Fault Recorded by a D25

- Winding Hottest Spot Model
- Insulation Aging Model
- Cooling Control Model
- Minute Average Apparent Power Model
- OLTC Temperature Differential Model
- Moisture Model
- On-Line Dynamic Loading Model The dynamic loading model incorporates outputs from the other models as well as key

The dynamic loading model provides the system operator with a perspective of the overloading capabilities of the transformer. Among other transformer sensors, the D25 provides seamless integration with GE's Hydran* to optimize equipment output and extend asset life.

Hardware

Flexible Modular I/O

The D25 includes a modular system to increase its I/O capacity. It can accommodate up to 96 digital inputs, 32 digital outputs, 32 analog inputs (DC), and 15 AC inputs to monitor 3-phase circuits. The D25 can also support single/double digital points and accumulators.

All I/O is monitored and recorded at a 1 ms resolution. To ensure data accuracy, the D25 can be time synchronized through IRIG-B, SNTP, or most SCADA protocols.

Fluxbuster™ AC analog inputs

This technology enables accurate post-fault analysis. The D25 can monitor and record current waveform levels up to 42 nominal values. This guarantees accurate recording of symmetrical fault current waveforms. The Fluxbuster technology does not sacrifice accuracy in order to provide a wide input range unlike many other protection devices. The Fluxbuster technology provides unparalleled accuracy of up to 0.3% of nominal (0.3% of nominal from 2% - 195% measurement range and 1.0% of nominal from 195% - 4200% measurement range).

High Current Control Card

The D25 can be equipped with a digital output module comprising of 32 relays, each rated at 10 A for 5 seconds and 4 A continuously. This can eliminate the need for separate interposing relays, reducing cost and saving valuable space within cabinets.

Scalable Analog Adapters

The D25 includes an optional customizable 32-point analog input card with multiple analog adapters. This enables you to pick and choose multiple types of DC analog inputs to meet a wide range of current and voltage requirements. Adapters can be changed in the field simply by plugging a different adapter on the module..

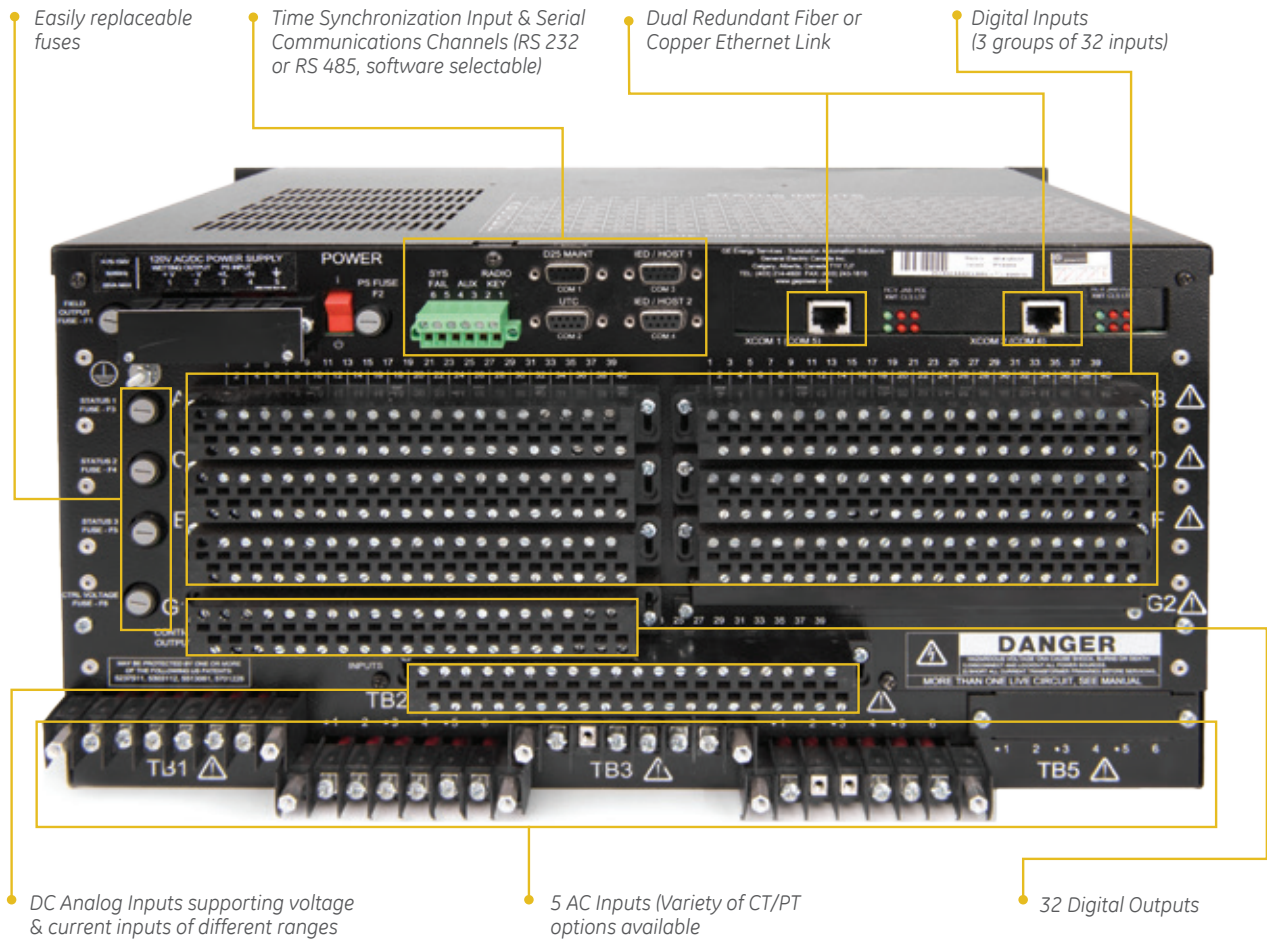
Digital Inputs

96 inputs are available with chatter filter to eliminate unwanted alarms. Single-point, double-point and accumulators can be configured using digital inputs. The wetting voltage of digital inputs can also be selected to meet site-specific requirements.

Manage Redundant I/O

The D25 is capable of managing redundant I/O based on the operational status of each device. The D25 can also maintain control functionality by redirecting a command to the final destination. This feature is unique within the GE Digital Energy suite of devices and allows for an easier integration with master stations.

Back Panel



Technical Specifications

Port Configurations

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|------------------------|---|
| AC Analog Inputs: | 0, 3, 6, 9, 12 or 15 inputs |
| DC Analog Inputs: | 0 or 16 inputs |
| Digital Status Inputs: | 0 to 96 inputs in increments of 32 |
| Control Outputs: | 0, 16, or 32 trip/close pairs or 32 isolated high current outputs with 8 optional current supervision |
| Host Comm Ports: | 2 serial (38.4 Kbps) or 2 Ethernet 10 Mbps and 100 Mbps options are available |
| IED Comm Ports: | 2 (38.4 Kbps) |
| Time Sync: | 1 IRIG-B Input |
| Configuration Port: | 1 Maintenance port |
| Display: | 1 D25 Display Port (9600 bps) |

Power Requirements

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|--|---|
| Input Options: | 20-60 Vdc 60-150 Vdc/85-135 Vac 50/60 Hz (CE) 150-350 Vdc/187-265 Vac 50/60 Hz (CE) |
| Maximum Power Consumption: | 65 W |
| Maximum Inrush Current on Cold Start: | 18 A (peak Amps) |
| Maximum Inrush Current under Dynamic Conditions 1: | 45 A (peak Amps) ¹ |

Communication Ports

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|----------------------------------|---|
| Maintenance Port: | WESMAINT II+ DB-9-F, RS-232 @ 9600 bps |
| D25 Display Port: | DB-9-F, RS-485 @ 9600 bps |
| UTC Time Port: | DB-9-F, RS-232/RS-422 |
| Standard Serial Comm. Ports (2): | DB-9-F, RS-232/485 up to 38400 bps |
| Optional Comm. Ports (2): | DB-9-F, RS-232/485 up to 38400bps, software configurable or Ethernet; 10/100TX, 10FL and 100FX options are available |
| AC Analog Value Measurement | |
| Configuration Options: | Direct AC analog inputs from CTs and PTs. Supports up to six 3-phase circuits Scaling factors are provided to allow fine-tuning of the nominal values of the AC inputs to match the actual nominal values of the field sources. |
| Analog Inputs: | 15 AC analog inputs organized in groups of three (3) inputs, Transformer isolated |
| Sampling Rate: | 64 samples per Power Line Cycle |
| A/D Resolution: | 13 bits plus sign |
| AC Voltage Inputs | |
| Nominal PT Input Options: | 63.5 Vrms, 69.3 Vrms, 110 Vrms, 120 Vrms, 220 Vrms |
| 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 @ nominal input |
| Accuracy 2: | ±0.5 % of nominal |
| Frequency: | ±0.01 Hz |
| Phase angle: | ±0.5° |

AC Current Inputs

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|---------------------------|---|
| Nominal CT Input Options: | 1 A rms or 5 A rms |
| Measurement Range: | 2% to 1600% of nominal for value measurement 2% to 4200% (asymmetrical) of nominal for DFR and protection |
| Thermal Overload: | 4 times nominal – continuous 30 times nominal – 10 seconds 100 times nominal – 1 second 10 minute duty cycle for inputs greater than 4 times nominal |

| | |
|-------------------------|---|
| Burden: | 16x 1A & 5A CT – Less than 0.2VA @ nominal input. 42x 1A CT – Less than 0.05 VA @ nominal input. 42x 5A CT – Less than 0.1 VA @ nominal input. |
| Accuracy ² : | 16x 1A & 5A CT – ±0.5% of nominal 42x 1A & 5A CT – ±0.3% of nominal Frequency ±0.03 Hz Phase angle ±0.5° |

General AC Features

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|-------------------------|---|
| RMS Data: | RMS magnitudes and phase angles for measured inputs. Supports L-L or L-N PT connections with calculation of L-L or L-N magnitudes and phase angles |
| Metering: | Electrical Power supports 1, 2, 21/2 and 3 element metering providing active, reactive, and apparent power; power factor per phase and circuit totals. Also provides displacement power factor angle per phase |
| Power Quality: | THD and harmonic spectrum data to the 21st harmonic for each AC input |
| Electrical Energy: | Import and export accumulators for kWh, kVAh, kVArh |
| Unbalance Detection: | Symmetrical component circuit unbalance detection and maximum deviation from average methods |
| Alarming: | High and low alarms on any analog data with qualifications of one power cycle or more |
| Line Frequency: | 50/60 Hz |
| Oscillography: | Waveform and event recording on up to 15 AC analog channels simultaneously with concurrent capture of up to 250 digital input points Analog sample rate: 64 samples/cycle Record length: 240 cycles with programmable pre- and post-capture times |
| Per-cycle Data Logging: | Capturing selected AC values and digital data every power cycle |
| Protection: | 3-step definite time over-current protection and breaker failure protection on all configured circuits |
| Accuracy 2: | Active/reactive/apparent power ±0.96% of nominal Power factor ±2.85% of FS Active/reactive energy ±2% of reading Apparent energy ±0.5% of reading |

DC Analog Value Measurement

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|------------------------|--|
| Configuration Options: | Scaling factors are provided to allow fine-tuning of the nominal values of the DC inputs to match the actual nominal values of the field sources |
| Analog Inputs: | 16 DC analog optically isolated differential inputs |
| Sampling Rate: | 40 samples/second @ 50 Hz; 50 samples per second @ 60 Hz; 2 samples are averaged before captured in the database (effective reporting rate is 20 samples/sec @ 50Hz, 25 samples/sec @ 60 Hz) |
| A/D Resolution: | 14 bits plus sign |

DC Current

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|------------------------------|---|
| Nominal Input Range Options: | ±1 mA, ±5 mA, ±10 mA, or ±20 mA |
| Input Burden: | 5K to 250Ω (1 to 20 mA) |
| Accuracy: | ±0.10% of full scale |
| Temperature Coefficient: | ±30 ppm/°C |
| DC Voltage | |
| Nominal Input Range: | ±5 Vdc |
| Measurement Range: | ±6 Vdc |
| Overload Voltage: | ±30 Vdc (NM) continuous, ±200 Vdc (CM) continuous |
| Input Impedance: | More than 10 MΩ |
| Accuracy: | ±0.05% of full scale |
| Temperature Coefficient: | ±15 ppm/°C |

Technical Specifications

Digital Inputs

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|---|--|
| General: | Up to 96 optically isolated (5000 Vrms), organized in cards of 32 inputs |
| Digital Input Options: | One of: 12, 24, 48, 120, 250 Vdc \pm 20%, bipolar inputs |
| Burden: | 1.2 to 10 mA, maximum power dissipation is 0.5 W per input |
| Contact Debounce: | Three-level programmable software filtering for debounce and chatter |
| Configurable Input Types: | Digital input, Sequence of Events with time-tagging accuracy of 1 ms, Change of State, Up to 8 digital inputs as Pulse Accumulator |
| On-Board Wetting Supply (not available with graphical display): | 24 Vdc or 48 Vdc (depends on supply ordered), isolated, external wetting optional |

Digital Outputs (D25KE)

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|-------------------------------------|--|
| Standard Digital Outputs: | 16 or 32 relay outputs switch one side of the controlled load; single component failure protection and detection preventing false control of any coil driver output; selectcheck- before execute security; master trip/master close bus scheme |
| Configurable Output Types: | Latching (On/Off), Trip/Close, Raise/Lower, Programmable pulse duration from 5 to (2 ³¹ -1) ms in 1 ms intervals |
| Output Relay Contacts: | 1 Form A |
| Maximum Switching Power: | 60 W or 125 VA (resistive) |
| Maximum Switching Voltage: | 75 Vdc or 50 Vac (DB-25) 120 Vdc (FACE-40) |
| Maximum Switching Current: | 2 A |
| Maximum Carrying Current: | 2 A |
| Operate Time: | 5 ms |
| Release Time: | 5 ms |
| Breakdown Voltage: | 1500 Vac for one minute (coil to contact) |
| Isolation between Adjacent Outputs: | 300 Vdc (with compression terminal block), 100 Vdc (with DB-25 connectors) |
| Interposing Relay Option: | Groups of 8 digital outputs can be directly interfaced to D20KI module |

High Current Digital Outputs (D25HC KE)

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|---|---|
| Standard Digital Outputs: | 32 isolated digital outputs with single component failure protection and detection, preventing false control of any coil driver output; select-check-before execute security 8 outputs with optional current supervision seal-in function |
| Configurable Output Types: | Raise/lower, Programmable pulse duration from 5 to (2 ³¹ -1) ms in 1 ms intervals |
| Output Relay Contacts: | 8x 1 Form C 16x 1 Form A 8x 1 Form A with optional current seal-in function |
| Maximum Make Current: | 10 A for 5 seconds |
| Maximum Continuous Carrying Current: | 4 A |
| Maximum Break Current: | 10 A @ 28 Vdc 0.85 A @ 60 Vdc 0.45 A @ 120 Vdc 0.3 A @ 300 Vdc |
| Maximum Switching Voltage: | 300 Vdc or 300 Vac |
| Current Sensing Level for Seal-In Function: | Min. 60 mA Max. 200 mA |
| Operate Time: | 7 ms |
| Release Time: | 10 ms |
| Isolation Between Adjacent Outputs: | 300 Vdc |
| Simultaneously Operated Outputs: | Maximum 16, includes maximum 4 with current supervision |

Auxiliary Digital Outputs

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|--|--------------------------|
| Radio Keying Output Relay Contact: | 1 Form A |
| Auxiliary Control Output Relay Contacts: | 1 Form A |
| System Fail Relay Contacts: | 1 Form B |
| Maximum Switching Power: | 60 W (resistive), 125 VA |
| Maximum Switching Voltage: | 75 Vdc or 50 Vac |
| Maximum Switching Current: | 2 A |
| Maximum Carrying Current: | 2 A |
| Breakdown Voltage: | 1500 V (coil to contact) |

Available Displays

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|---------------|--|
| Alphanumeric: | Backlit LCD with keypad |
| Graphical: | Backlit LCD with touch screen, 320 X 240 pixels, 4.76" X 3.58" |

Physical Specifications

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|-------------------------------------|--|
| Dimensions: | 19" (48cm) Width, 8.75" (22cm) Height, 9" (23cm) Depth |
| Weight: | 31 lbs. (14.1kg) maximum |
| Operational Temperature: | -20°C to +70°C (without display), 0°C to +60°C (with alphanumeric display), 0°C to +50°C (with graphical display) |
| Storage Temperature: | -40°C to +90°C (without alphanumeric display), -20°C to +70°C (with alphanumeric display), 0°C to +70°C (with graphical display) |
| Humidity Rating: | 0 to 95% relative humidity, non-condensing |
| Environmental Rating: | IP20 |
| Installation/Over-voltage category: | Class II |
| Pollution Degree: | 2 |

Product Compliance

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|-----------------|--|
| EN55011 | Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment |
| EN61000-3-2 | Limits for Harmonic Current Emissions (applicable for AC power supply only) |
| EN61000-4-2 | ESD/Immunity Test |
| EN61000-4-3 | Radiated, radio-frequency, electromagnetic field immunity Test |
| EN61000-4-4 | Electrical Fast Transient/Burst Immunity Test |
| EN61000-4-5 | Surge Immunity Test |
| EN61000-4-6 | Immunity to conducted disturbances induced by radio-frequency fields |
| EN61000-4-8 | Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests (applicable for AC power supplies only) |
| EN61000-4-11 | Oscillatory Waves Immunity Test |
| EN61000-4-12 | Product safety |
| EN61010-1 | Cold |
| IEC® 600068-2-1 | Dry heat |
| IEC 600068-2-2 | Vibration |
| IEC 600068-2-6 | Damp heat, cyclic (12+12-hour cycle) |
| IEC 600068-2-30 | Drop and topple |
| IEC 600068-2-31 | Test for Immunity to Conducted, Common Mode |
| EN61000-4-16 | Disturbances in the Frequency Range 0 Hz to 150 kHz (steady state frequency). |

