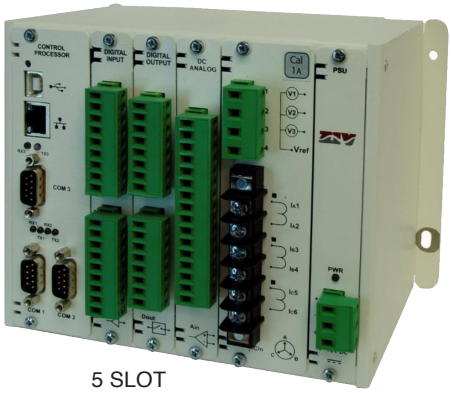
ZIV MV Flexible RTU

Distribution Automation Platform

8 SLOT
I/O CHASSIS



5 SLOT
I/O CHASSIS

Features

- ✓ RMU multiple Feeder Monitoring.
- ✓ Directional Fault Detection.
- ✓ Disturbance Recording.
- ✓ Selection of Sensor Interfaces.
- ✓ Setpoint Control of DERs.
- ✓ DER Net Power Management.
- ✓ DER Failsafe Operation.
- ✓ Gateway (protocols incl. 61850).
- ✓ Extensive Cyber Security Features.
- ✓ Secure Web Server HMI (SLD...).
- ✓ IEC61131-3 Logic Automation Tool.
- ✓ Integrated GPS Clock (Option).
- ✓ Two Ethernet & four Serial Ports.
- ✓ Certified to power utility standards.
- ✓ Multiple Master Stations connectivity.

Flexible & Modular **RTU / Controller** Perfectly Suited to Secondary Distribution Automation

MAC-020 · AC Analogue Module
MAI-010 · DC Analogue Module
MAO-010 · Analogue Output Module
MCP-012 · Processor Module
MDI-010 · Digital Input Module
MDO-010 · Digital Output Module
Cyber Security
ZIV WebHMI and Web HMI Editor
Technical Information

Making the Smart Grid Real

Introduction

The **ZIV MV Flexible RTU** is a modular RTU / Controller that is ideally suited to low or medium I/O counts. It supports a range of I/O modules including Status Inputs, Control Outputs, DC Analogues, AC Analogue measurements and Analogue Outputs. All modules are certified for use in power utility applications.

The unit is ideally suited to Distribution Automation where it can monitor pole top switches or ground-mounted RMUs as well as offering a cost-effective solution for extensible MV/LV switchgear applications and LV feeder monitoring.

The USP has the flexibility to provide powerful local functionality at the secondary distribution level for Generator Constraint Management, CMZ control for renewable generation, export limitation schemes and RMU management, while meeting the highest industry standards of performance.

Secondary Substation Platform

The **ZIV MV Flexible RTU** with its powerful processor and range of communications ports is the core component of any Secondary Substation Automation System.

The module supports all the standard protocols for Control Centre communications including Secure IEC 104, DNP3 SAV5, IEC101 and an extensive range of legacy protocols.

The **ZIV MV Flexible RTU** also has the capability of operating as the gateway for virtually all substation IEDs using protocols such as IEC 61850 Client & Server (KEMA certified), IEC 101/104, DNP3.0 (TCP/IP & Serial), IEC 103 and Modbus (TCP/IP & Serial).

RMU Controller

The unit is used extensively as an RMU / Switch Controller based on its size, interface flexibility, fault detection and cybersecurity.

The unit supports a wide variety of interfaces for AC voltages and currents including conventional CT/VTs, LEA (Low Energy Analogues), Rogowski sensors, Line Post sensors and other low voltage input ranges. This ensures that it can interface with different RMU / Switch types.

The unit supports **extensive fault detection** including:

- Voltage Presence/Absence detection
- Fault Current Indication
- Broken Conductor (ANSI 47)
- Directional Fault detection (ANSI 67, 67N,50/51)
- Non-Directional Fault detection (ANSI 50N/51N)
- Under-voltage / Over-voltage detection (ANSI 27, ANSI 59)
- Undercurrent Detection (ANSI 37)
- LV Power quality including Voltage dip / swell / interruption and Unbalanced Current.
- Disturbance Fault logging with pre-and post-fault cycle logging and fault file retrieval.

DER Controller

The **ZIV MV Flexible RTU** is widely used as a DER (Distributed Energy Resource) Controller based on its DER Management capabilities, setpoint controls, failsafe operation, interface flexibility and cybersecurity.

The unit can operate as a standalone DER Controller managing the power import/export limits from a particular DER site or as part of an integrated ANM (Active Network Management) scheme or both.

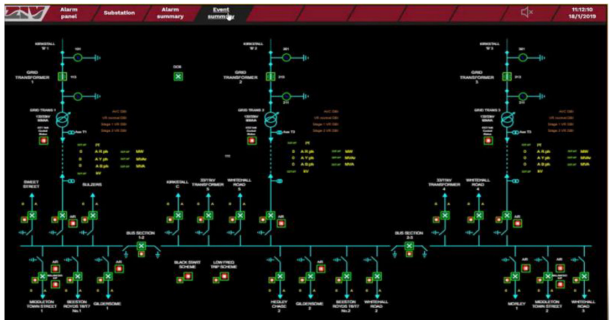
The unit can manage generation to ensure network voltage limits are no violated. It can also monitor that the generator is operating within its allowed P/Q envelope. It supports both hardwired setpoint controls and serial setpoint controls to interface with various types of DERs.

It provides fail safe operation by monitoring the DER against issued setpoints and taking pre-defined action if the setpoint isn't followed. As part of a larger ANM scheme it will take failsafe action in the event of communications failure.

Ideally suited to Secondary Automation where it can monitor **pole top switches** or **ground-mounted RMUs**

WEBHMI

The **ZIV MV Flexible RTU** supports a webserver-based HMI, offering extensive monitoring and control capabilities. It supports full substation Single Line Diagrams, feeder diagrams or simple push-button displays as required. It provides SOE (Sequence of Events) and Alarm Lists for data points and derived points as configured. Secure Role Based Access Control allows View-Only access or full Plant Control from the HMI depending on the configuration.



Cyber Security

It is designed to meet all the latest Cyber security requirements to fulfil IEC62351. It supports role-based-access-control (RBAC) and centralised user management using secure LDAP and RADIUS. It supports TLSv1.3, IPsec VPN, secure SCADA protocols, secure Syslog and a programmable Firewall.

The unit is independently PEN (Penetration) tested and the unit will only run Vendor signed hardware and software modules. Centralised Software / Patch Management is also available.

Plant Interface

The unit provides two Ethernet ports and four configurable RS232/485 serial ports and one USB configuration port.

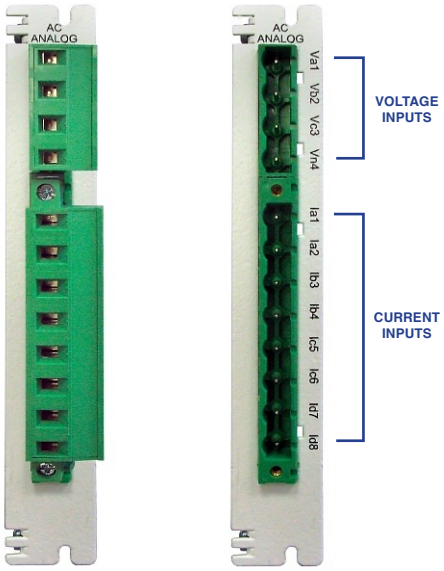
It supports a range of plant interface modules:

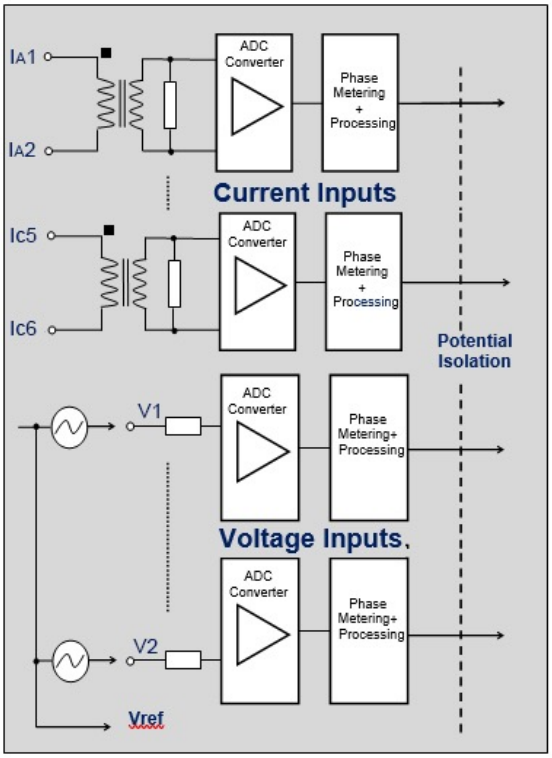
- AC Measurement Modules with 3 Voltage and 3-4 Current channels providing RMS, Power, Phase & Frequency measurements including support for directional fault detection.
- DC Measurement Modules, each with 8 channels for reading input ranges 0-1V, 0-10V, ± 1V, ± 5V, ± 10V, ± 20mA, 4-20mA.
- DC Setpoint Modules each with 4 channels and each output configurable between ±20mA as standard or a build option for ± 10VDC. These provide setpoint controls for controlling generators or variable loads.
- Digital Input Modules each with 16 opto-isolated digital inputs operating as voltage-inputs in two groups of 8 channels with either positive or negative common.
- Digital Output Modules each with 8 outputs providing single-pole relays capable of switching 5A at 30 VDC or 0.5 A at 125 VDC.

The **ZIV MV Flexible RTU** with its **powerful** processor and **range** of communications ports is the **core** component of any **Secondary Substation** Automation System.

MAC-020

AC Analogue Module





Introduction

The MAC-020 is a high accuracy input module for AC metrics. It supports 3 AC voltage inputs and 4 AC current inputs.

The unit will provide RMS values, MW, MVar, MVA, frequency, phase angles, harmonic data and full protection algorithm support.

The input current range is 1 or 5 Amps and the input voltage range is 0-275 VAC although low voltage inputs from LEA (Low Energy Analogues) line-post sensors are also supported for both. The 3 AC voltage inputs share a common VN4 (Vref).

Features

- ✓ RMU multiple Feeder Monitoring.
- ✓ 3 Voltage & 4 Current Inputs
- ✓ Power calculations based on paired Voltage and Current channels
- ✓ Derived Measurements: MV, MVar, MVA, Power Factor, Phase Angle & Frequency
- ✓ Supports Fault / Protection algorithms
- ✓ High Accuracy
- ✓ Fault passage detector and COMTRADE Oscillography functionality.

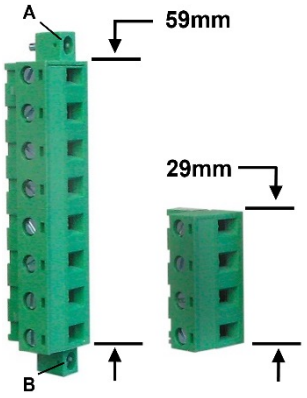
Technical Information

Module Related Data	
Number of Inputs	• 3 AC Voltage & 4 AC Current
Type of Input	• Current Differential; Voltage shared common
Measurement Accuracy	• ±0.25% of nominal range
Linearity	• 0.008%
Voltage Input Range	• 275 VAC nominal (420 VAC max.) [Low voltage inputs also available]
Voltage Input Resistance	• > 300 kΩ
Current Input Interface	• Internal CT [Rogowski & low voltage inputs also available]
Current Input Range	• 1A (2A max.) & 5A (10A max.)
Bandwidth	• 2 kHz
Isolation	• 4.2 kVAC one minute
Module Power Consumption	• 600 mW
Protection Algorithm Support & Accuracy	
Protection Algorithm Support	• ANSI 27,47,50,52,59,67, FPD & Fault Isolation
Derived Measurements	• MW, MVar, MVA Phase Angle Frequency
Accuracy	• +/- 1%, +/- 1%, +/- 1%, 2º, 0.02Hz
Electromagnetic Immunity	
High Frequency Disturbance	• IEC61000-4-12,C37.90.1, IEC60255-22-1
Fast Transient Disturbance	• IEC61000-4-4, C37.90.1, IEC60255-22-4
Electrostatic Discharge	• IEC 61000-4-2, IEC60255-22-2
Radiated Immunity	• IEC 61000-4-3, CISPR 22
High Frequency Conducted Immunity	• IEC 61000-4-6
Power Frequency MF Immunity	• IEC 61000-4-8
Emissions	• IEC 61000-6-4
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage	• IEC 60068-2-1 & IEC 60068-2-2 -20°C to +70°C -40°C to +85°C
Relative Humidity	• IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing]
Vibration	• IEC 60068-2-6
Drop & Topple	• IEC 60068-2-31
Weight & Dimensions	
Dimensions	• 20 X 133 X 125mm
Weight	• Approx. 185 grams

Connectivity

Frontal View

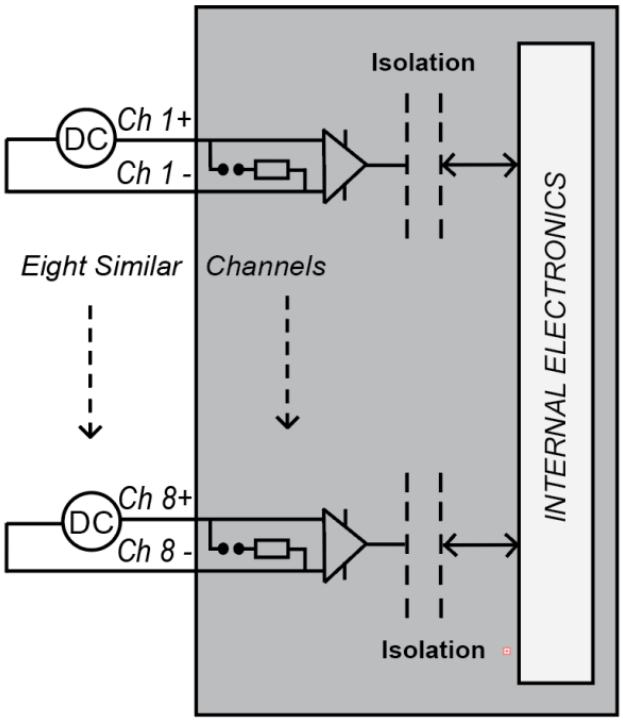
Connector Detail



No of Ways: Eight & Four
Pitch: 7.62 mm
Gender: Female
Screw Type: Slot Head
Wire Strip Length: 7 up to 8mm
Wire Gauge: 12 to 24 AWG
Torque: 0.56Nm
Retention:M2.5 set screws A & B

MAI-010

DC Analogue Module



Introduction

The MAI is an 8 channel DC analogue input module which provides the measurement options for 0-1V, 0-10V, ± 1V, ± 5V, ± 10V, ± 20mA and 4-20mA.

Selectable between current and voltage input. Consult the USP-020 User Manual for switch setting information and details. The unit also has an option for providing power for the RTD temperature sensors.

Connections are via a single 16-way removable plug to a fixed card side socket. This greatly simplifies panel build and allows for easy connection/ disconnection of plant wiring.

Features

- ✓ 8 DC analogue channels
- ✓ Supports voltage or current inputs
- ✓ Software selected input ranges
- ✓ High Accuracy and Stability
- ✓ Differential Input
- ✓ 5 kVDC Isolation
- ✓ 5.08mm pitch plugs/sockets

Technical Information

Module Related Data	
Number of Inputs	• 8 Channels
Input Range (nominal)	• 0-1V, 0-10V, ± 1V, ± 5V, ±10V, ± 20mA & 4-20mA
Voltage or Current selection	• Link selectable
Type of Input	• Differential
Resolution	• 15 bit plus sign
Isolation	• 5 kVDC
Differential Voltage Between Inputs Max	• 24 V
Surge Clamp	• 32V (Between input and potential earth)
Power Consumption	• 600 mW
Input Resistance	• 220 Ω for current or >1 MΩ for voltage
Accuracy	• 0.1%
Linearity	• Max 0.10% non-linearity
Common Mode Rejection Ratio	• 100 dB
Normal Mode Rejection Ratio (50 Hz)	• 40 dB
RTD Input	• Option for 2, 3 or 4 -wire sensors on maximum seven channels

Electromagnetic Immunity	
High Frequency Disturbance	• IEC61000-4-12,C37.90.1, IEC60255-22-1
Fast Transient Disturbance	• IEC61000-4-4, C37.90.1, IEC60255-22-4
Electrostatic Discharge	• IEC 61000-4-2, IEC60255-22-2
Radiated Immunity	• IEC 61000-4-3, CISPR 22
High Frequency Conducted Immunity	• IEC 61000-4-6
Power Frequency MF Immunity	• IEC 61000-4-8
Emissions	• IEC 61000-6-4

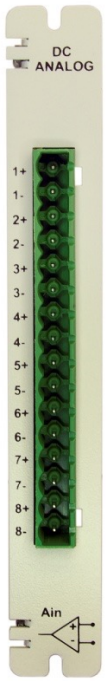
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage	• IEC 60068-2-1 & IEC 60068-2-2 -25°C to +60°C -40°C to +85°C
Relative Humidity	• IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing]
Vibration	• IEC 60068-2-6
Drop & Topple	• IEC 60068-2-31

Weight & Dimensions	
Dimensions	• 20 X 133 X 125mm
Weight	• Approx. 113 grams

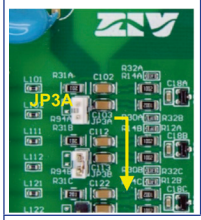
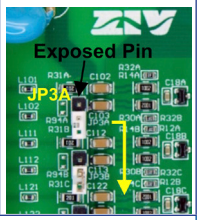
Connectivity

Frontal View & Connector Detail

No of Ways: 16
Pitch: 5.08mm
Gender: Female
Screw Type: Slot
Wire Strip Length: 7 up to 8mm
Wire Gauge: 12 to 24AWG



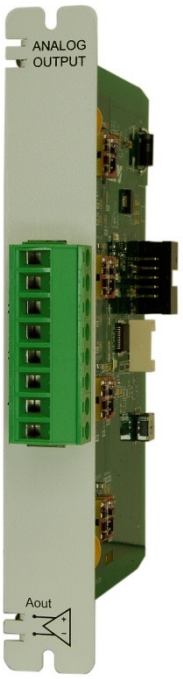
Channel Mode Selection

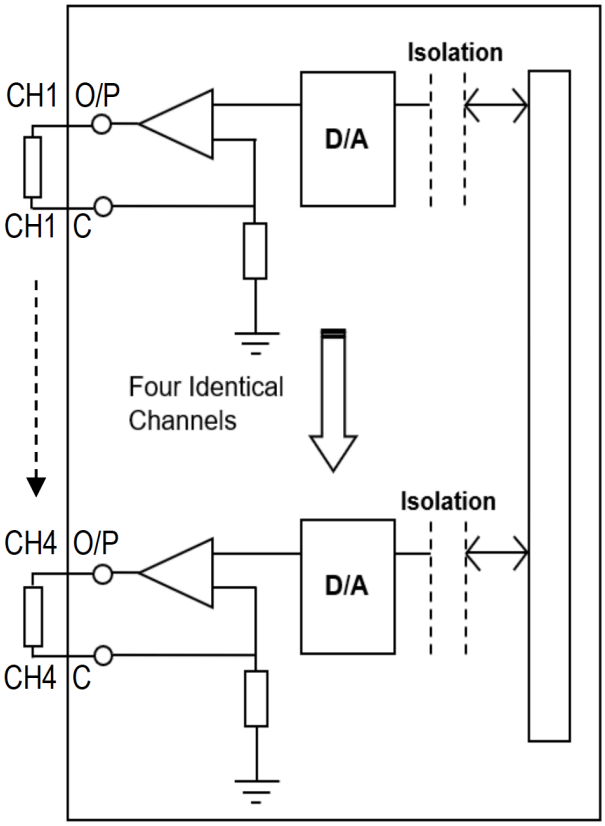
Current Input	Voltage Input
	

Current or Voltage mode operation is facilitated on a per channel basis by means of 8 jumper/pin headers annotated JP3A to JP3H. The jumper is inserted for current and removed for voltage mode operation.

MAO-010

Analogue Output Module





Introduction

The MAO-010 is a 4-channel individually isolated analogue output module for the USP. The current output range is ±20mA with a build option providing for ±10VDC outputs. Both the current and voltage card variants feature 20% overrange.

The design allows for a loop resistance up to 1500 Ohms.

Connections are via a single 8-way removable plug to a fixed card side socket. This greatly simplifies panel build and allows for easy connection/ disconnection of plant wiring.

Features

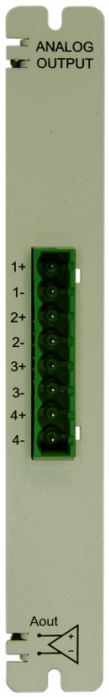
- ✓ 4 Analogue output channels
- ✓ Individually isolated channels
- ✓ ±20mA output (optional ±10VDC)
- ✓ High Accuracy
- ✓ High Stability
- ✓ High noise immunity
- ✓ 5.08mm pitch plugs/sockets

Technical Information

Module Related Data	
Number of Outputs	• 4 Bipolar Individually Isolated
Output Range	• ±20mA with 20% overrange (Standard Module) ±10VDC with 20% overrange (Build Option)
Settling Time	• 10ms to 1%
Main Loop Impedance	• 1500 Ohms (Max)
Isolation	• 3kVRMS
Max Differential Voltage between Outputs	• 2000VDC
Power Consumption	• 10W (all channels at full scale)
Common Mode Rejection Ratio	• >60db
Accuracy	• 0.1%
Linearity	• 0.1%
DAC Resolution	• 16-bit
Electromagnetic Immunity	
High Frequency Disturbance	• IEC61000-4-12,C37.90.1, IEC60255-22-1
Fast Transient Disturbance	• IEC61000-4-4, C37.90.1, IEC60255-22-4
Electrostatic Discharge	• IEC 61000-4-2, IEC60255-22-2
Radiated Immunity	• IEC 61000-4-3, CISPR 22
High Frequency Conducted Immunity	• IEC 61000-4-6
Power Frequency MF Immunity	• IEC 61000-4-8
Emissions	• IEC 61000-6-4
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage	• IEC 60068-2-1 & IEC 60068-2-2 -25°C to +70°C -40°C to +85°C
Relative Humidity	• IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing]
Vibration	• IEC 60068-2-6
Drop & Topple	• IEC 60068-2-31
Weight & Dimensions	
Dimensions	• 20 X 133 X 125mm
Weight	• Approx. 101 grams

Connectivity

Frontal View

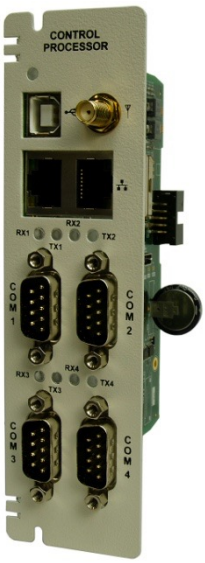


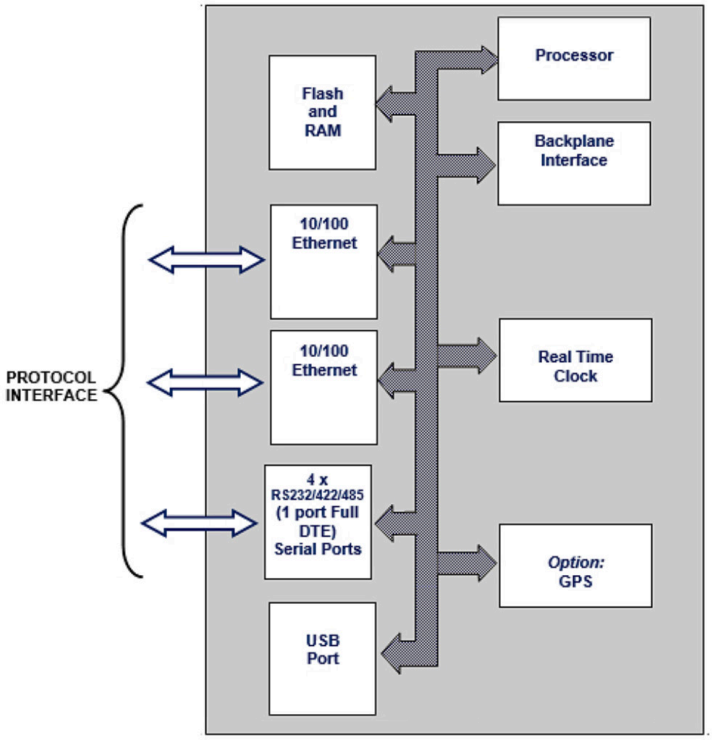
Connector Detail

No of Ways: Eight
Pitch: 5.08mm
Gender: Female
Screw Type: Slot Head
Wire Strip Length: 7 up to 8mm
Wire Gauge: 12 to 24 AWG

MCP-012

Processor Module





Introduction

The MCP-012 module provides a range of communication options including Ethernet and four configurable RS-232 / RS-485 ports. It supports industry standard protocols including IEC61850, DNP3, IEC104, IEC101, IEC103 and Modbus.

It supports a full range of I/O modules including Status Inputs, Control Outputs, DC Analogue Input, Analogue Outputs (Setpoints) and direct AC Analogues measurements (with option for fault detection).

The module has 2 x RJ-45 Ethernet ports and a GPS Clock Option for high precision timekeeping.

Features

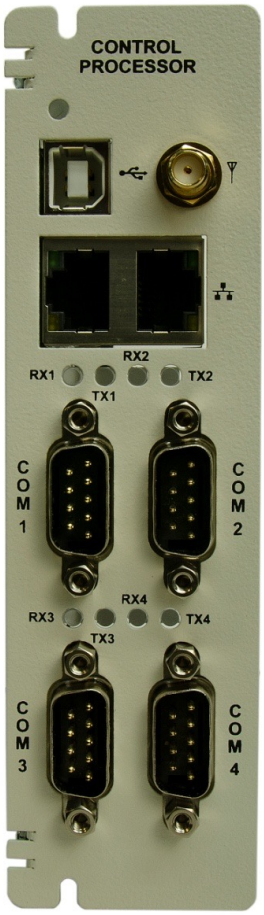
- ✓ 2 x 10/100 Ethernet interface
- ✓ 4 x RS-232/422/485 ports, one port full DTE interface.
- ✓ USB configuration port
- ✓ Supports Analogue Setpoint and direct AC Measurement
- ✓ Multiple protocol support (IEC61850), IEC104, IEC101, IEC103, DNP, Modbus)
- ✓ Super-cap backed precision RTC
- ✓ On-board GPS option

Technical Information

Data Acquisition and Processing	
Time Stamping Precision RTC GPS Clock Option for high precision timekeeping	• 1ms • Precision MEMS RTC with super-cap backup • 66 channel phase tracking receiver, C/A code, L1 frequency (1575.42MHz) Sensitivity: -147dBm Time Server: NTP/SNTP/IEC61850 Antenna: BNC socket, 2.8V @ 50mA
Module Related Data	
Processor FLASH RAM	• 32 bit, 525MHz processor • 256 MB NAND FLASH, option to 1 GB • 128 MB LPDDR3 RAM, option to 1 GB
Power Consumption	
Module Power Consumption	• 2.5 W
Indications, Controls and Diagnostics	
Data Display Panel Communications LEDs	• Option for OLED data display panel • Rx & Tx status LEDs
Serial Ports	
Speed Maximum Physical Interfaces	• Up to 115,200 bits/s • 4 x RS-232/422/485; 1 x port support full DTE interface(TxD, RxD, RTS, CTS, DTR DCD, DSR, RI) • 1 x USB Port
Ethernet	
Ports and Speed Physical Interface	• 2 x 10/100 Mbit Ethernet • 100Base-TX (RJ-45 connection)
Electromagnetic Immunity	
High Frequency Disturbance Fast Transient Disturbance Electrostatic Discharge Radiated Immunity High Frequency Conducted Immunity Power Frequency MF Immunity Emissions	• IEC61000-4-12,C37.90.1, IEC60255-22-1 • IEC61000-4-4, C37.90.1, IEC60255-22-4 • IEC 61000-4-2, IEC60255-22-2 • IEC 61000-4-3, CISPR 22 • IEC 61000-4-6 • IEC 61000-4-8 • IEC 61000-6-4
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage Relative Humidity Vibration Drop & Topple	• IEC 60068-2-1 & IEC 60068-2-2 -20°C to +75°C standard -40°C to +85°C • IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing] • IEC 60068-2-6 • IEC 60068-2-31
Weight & Dimensions	
Dimensions Weight	• 40 X 133 X 125mm • Approx. 173 grams

Connectivity

Frontal View



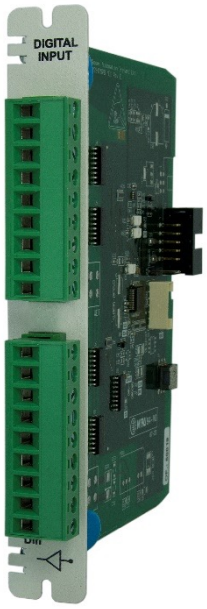
DB9 Serial Port Detail

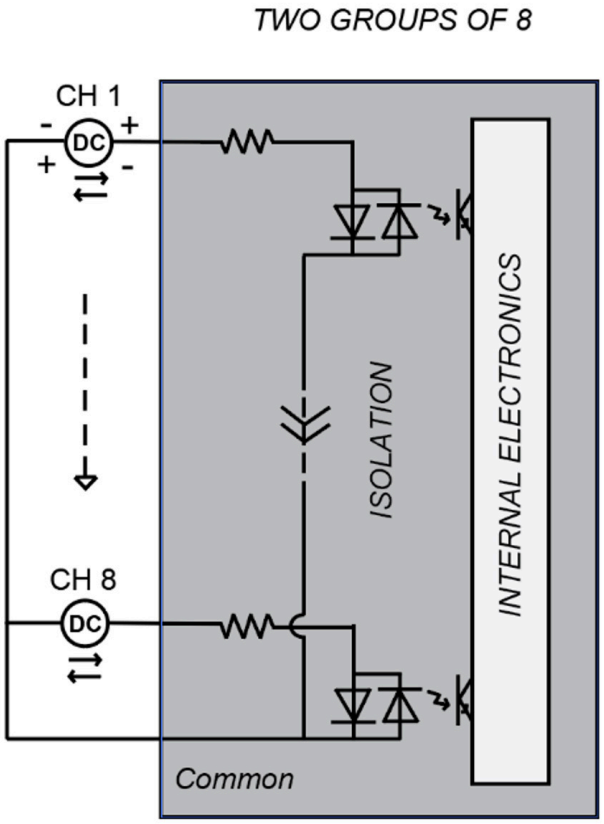
RS232 / RS485 / RS422 software selectable

PIN	Function RS232	Function RS485	Function RS422
1			
2	RxD		Rx422A+
3	TxD	TRx485B-	Tx422B-
4			
5	GND	GND	GND
6			
7	RTS	TRx485A+	Tx422A+
8	CTS		Rx422B-
9			

MDI-010

Digital Input Module





Introduction

The MDI digital input module has 16 digital input channels organized as two groups of 8 with respective commons.

It accepts bidirectional Voltage-Driven inputs.

The MDI provides optically isolated input channels with field voltage ranges from 18 to 72V DC and 36 to 150V DC.

Connections are via a pair of 9-way removable plugs to fixed card side sockets. This greatly simplifies panel build and allows for easy connection/ disconnection of plant wiring.

Features

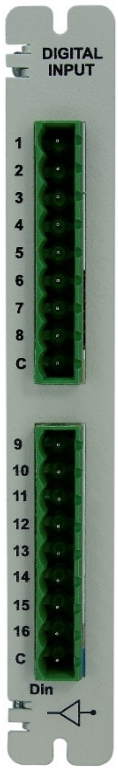
- ✓ 16 Digital input channels
- ✓ Interrupt driven 1ms timestamp
- ✓ Voltage-driven operation
- ✓ Bi-directional inputs
- ✓ 18-72V or 36-150V input voltage
- ✓ High noise immunity
- ✓ 5.08mm pitch plugs/sockets

Technical Information

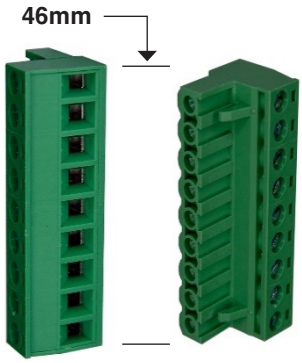
Module Related Data	
Number of Inputs	• 16 [2 input groups of 8 with separate commons]
Type of Input	• Voltage-Driven [Bi-directional positive or negative earth]
Max Differential Voltage Between Inputs	• 250 VDC
Isolation	• 5.3 kVDC
Module Power Consumption	• 150 mW
Input Circuit	
Channel Input Voltage	• 18-72 VDC, MDI-010-00 36-150VDC, MDI-010-01 (Option)
Input Resistance	• 44 KΩ (18-72VDC)
Filter & Acquisition Times	
Time Stamp Resolution	• 1 ms
Debounce time (all points)	• 0-60000ms Software configurable per channel
Filter Times	• On/Off (0-60000ms) [Software configurable per channel]
Auto Suppression	• Software configurable per channel
Electromagnetic Immunity	
High Frequency Disturbance	• IEC61000-4-12,C37.90.1, IEC60255-22-1
Fast Transient Disturbance	• IEC61000-4-4, C37.90.1, IEC60255-22-4
Electrostatic Discharge	• IEC 61000-4-2, IEC60255-22-2
Radiated Immunity	• IEC 61000-4-3, CISPR 22
High Frequency Conducted Immunity	• IEC 61000-4-6
Power Frequency MF Immunity	• IEC 61000-4-8
Emissions	• IEC 61000-6-4
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage	• IEC 60068-2-1 & IEC 60068-2-2 -25°C to +70°C -40°C to +85°C
Relative Humidity	• IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing]
Vibration	• IEC 60068-2-6
Drop & Topple	• IEC 60068-2-31
Weight & Dimensions	
Dimensions	• 20 X 133 X 125mm
Weight	• Approx. 110 grams

Connectivity

Frontal View

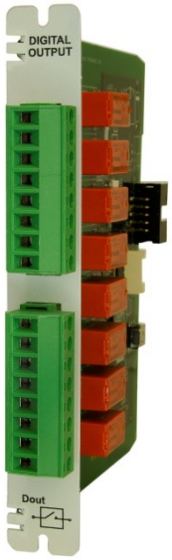


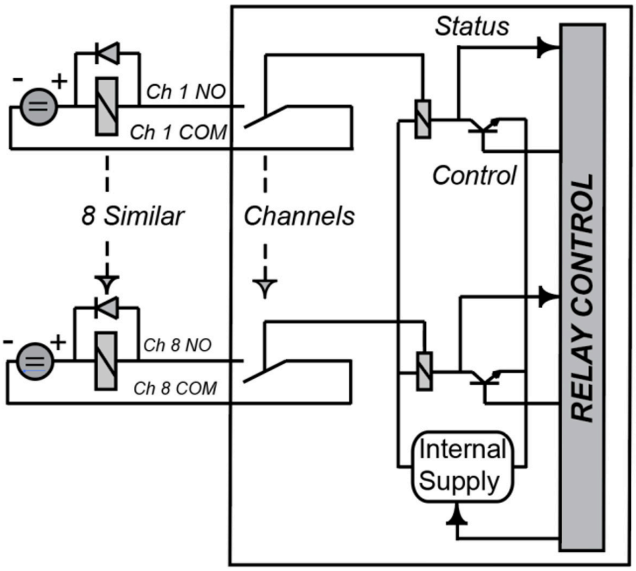
Connector Detail



No of Ways: Nine
Pitch: 5.08mm
Gender: Female
Screw Type: Slot Head
Wire Strip Length: 7 up to 8mm
Wire Gauge: 12 to 24 AWG

MDO-010





Introduction

The MDO is an 8 channel digital output module with a single normally open contact per channel. Suitable for 125VDC operation

The MDO offers secure control operation and supports both pulsed and latched output operations.

Connections are via a pair of 9-way removable plugs to fixed card side sockets. This greatly simplifies panel build and allows for easy connection/ disconnection of plant wiring.

Features

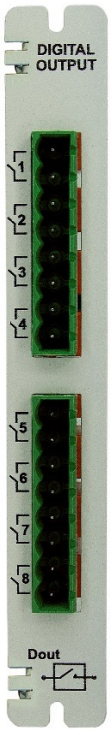
- ✓ 8 normally open relay contacts
- ✓ Pulsed and latched operation
- ✓ Select, –Check, Execute & Control Output Functionality
- ✓ Suitable for 125V DC operation
- ✓ 5.08mm pitch plugs/sockets

Technical Information

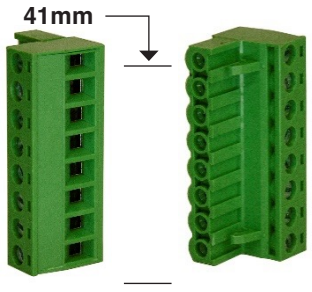
Module Related Data	
Number of Outputs	• 8
Type of Output	• Relay Contact [1 Normally Open, single pole relay per channel]
Max Differential Voltage	• 250 VDC (Between terminals)
Contact to Coil Isolation	• 5.3 kVDC
Module Power Consumption	• 150 mW + 400 mW per active relay
Output Characteristics	
Type	• Form A (Normally Open, Single Pole)
Maximum Carrying Current	• 5A
Switching Current	• 5A @ 250VAC, 5A @ 30VDC, 2A @ 48VDC & 0.5A @ 125VDC
Electromagnetic Immunity	
High Frequency Disturbance	• IEC61000-4-12,C37.90.1, IEC60255-22-1
Fast Transient Disturbance	• IEC61000-4-4, C37.90.1, IEC60255-22-4
Electrostatic Discharge	• IEC 61000-4-2, IEC60255-22-2
Radiated Immunity	• IEC 61000-4-3, CISPR 22
High Frequency Conducted Immunity	• IEC 61000-4-6
Power Frequency MF Immunity	• IEC 61000-4-8
Emissions	• IEC 61000-6-4
Environmental Conditions	
Temperature - Continuous Operation - Transportation & Storage	• IEC 60068-2-1 & IEC 60068-2-2 -20°C to +60°C & -40°C to +75°C extended -40°C to +85°C
Relative Humidity	• IEC 60068-2-3 & IEC 60068-2-78 [0 to 95% non-condensing]
Vibration	• IEC 60068-2-6
Drop & Topple	• IEC 60068-2-31
Weight & Dimensions	
Dimensions	• 20 X 133 X 125mm
Weight	• Approx. 138 grams

Connectivity

Frontal View



Connector Detail



No of Ways: Eight
Pitch: 5.08mm
Gender: Female
Screw Type: Slot Head
Wire Strip Length: 7 up to 8mm
Wire Gauge: 12 to 24 AWG

Cyber Security

Introduction

In the past, substation networks were traditionally isolated, and the protocols and data formats used to transmit information between devices were often proprietary. Because of this, the substation environment was very safe from cyberattacks. The terms used for this type of inherent security are:

- Security by isolation (if the substation network is not connected to the outside world, it cannot be accessed from the outside world).
- Security by obscurity (if data formats and protocols are proprietary, they are difficult for a third party to interpret).

The increasing sophistication of protection devices, together with the advancement of technology and the requirement for interoperability between manufacturers, have resulted in a standardization of networks and data exchange in substations. Today, devices within substations use standardized protocols for communications. In addition, substations can connect to open networks, such as the Internet and vast corporate networks, which employ standardized protocols for communications. This introduces a greater security risk, making the network vulnerable to cyberattacks, which could result in a higher electrical failure rate.

Clearly there is now a need to secure communications and devices in substations. Cybersecurity provides protection against unauthorized disclosure, transfer, modification or destruction of information or information systems, whether accidental or intentional.

To achieve this, there are several security requirements:

- Confidentiality (avoid disclosing information to unauthorized individuals).
- Integrity (avoid modification of unauthorized information).
- Availability (avoid denial of service).
- Non-repudiation (avoid denying that an action was taken or asserting that it was done when it was not done).
- Traceability / Detection (monitoring and logging of activity to detect intrusions and analyze incidents).
- Identification and authentication (avoid access to the device from unauthorized users and applications).
- Authorization (limit the actions a user or application can execute according to their assigned permissions)

ZIV cybersecurity solution has been implemented considering the **leading cybersecurity standards** and **guidelines**, such as IEC 62443, IEC 62351, IEEE 1686 and NERC CIP.

Cyber Security Features

Cyber Security Features Available in ZIV Flexible RTU	
Application Layer Protocols	• SSH (RFC 4251, RFC 4252, RFC 4253, RFC 4254, RFC 4255) • SFTP Server (Coming soon) • TLSv1.3 with X.509 (RFC 5246) and Mutual Authentication • SNMP V3 • DNP3 SAv5 • IEC 60870-5-101/104 protocols with IEC 62351-3 and -5
Authentication Features	• Role Base Access Control (RBAC) • Local and Remote Authentication • 2-Factor Authentication / OTP • Radius Client (Coming soon) • LDAPS Client
Web Server	• HTTPS
Security Logs	• Secure SYSLOG Client • IEEE Std 1686-2013 Audit Trail Logs
OS Security Features	• Application Signature • Secure Boot
Secure Connectivity	• TLS 1.2 min. encapsulation for Communication with ZIV Tools • VPN over IPSEC • Firewall
Hashing algorithms	• SHA2-256 • SHA2-512
Ciphers algorithms	• AES 128 bits and 256 bits • Blowfish • Variable RSA key sizes (512-4096)
Secure Certificates Support	• X509 with PKCS#8 (RFC 5958) and PKCS#12 (RFC 7292) • PKI configuration with passphrase for the private key • SSL certificate verification • Online Certificate Status Protocol (OCSP) support • Certificate Revocation List (CRL) support

Notes

- ✓ All referenced protocols are compliant with the published standards.
- ✓ **Penetration Tests** are regularly performed by specialist third-party cybersecurity companies.

ZIV WebHMI and Web HMI Editor

The most efficient way to manage the substation

The WebHMI is an advanced browser application that offers a professional graphical interface that simplifies and enhances the ZIV Automation user experience; no more complicated software installations will be needed to allow the operator to keep the Substation under control.

The WebHMI Editor is a tool designed to create modern Single Line Diagrams and customised symbols that can be displayed by the WEBHMI inbuilt in the ZIV Automation products. The WebHMI is the best and most cost-effective tool to increase the operator's response time.

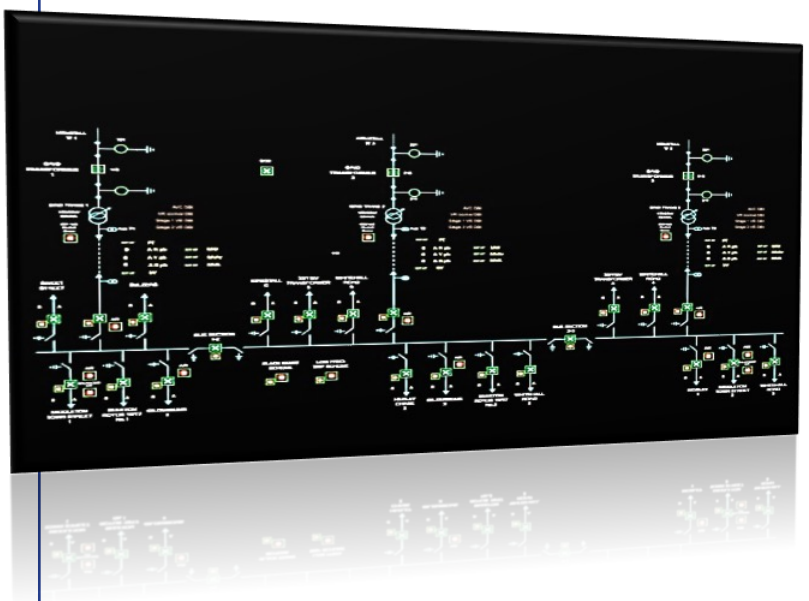
The WEBHMI is the best choice for any substation:

- ✓ Browser Based
- ✓ Customizable Friendly Interface
- ✓ Multi View Single Line Diagrams Plugin
- ✓ Security Dashboard Plugin
- ✓ Multi Dynamic Pages
- ✓ SOE Log with msec timestamp
- ✓ Alarm Panel
- ✓ Alarms Summary
- ✓ Events Summary
- ✓ Graphical Summary Diagrams
- ✓ Filters
- ✓ Diagram & Symbols Editor
- ✓ SLD Configuration Editor
- ✓ Two Factor Authentication

The **ideal tool** to effectively display the substation data **for the operators**

The interface is intuitive, efficient and user oriented, it can represent any type of Substation or UI using both the standard electrical symbol library or customised symbols, in the Single Line Diagrams.

The SLDs have high resolution and allows the user to drill down for more detail. The SLDs support data quality and invalid status so the user is fully aware of the plant status and measurements.



ZIV WebHMI and WebHMI Editor

The most efficient way to manage the substation

User Friendly

Various menus allow the user to navigate to different screen displays or settings menus; the menu are organized in different specialization levels. The **WEBHMI** may include easily configurable tables such as the **Events** and **Alarm Summaries** and is supplied with a standard **Annunciator** screen; filters and navigation buttons improve analysis of data and permit easy access to all the features available. Colour changes and blinking are used on the display when the user's attention is required. **Event and Alarms are also summarized by pie diagrams and graphs**.

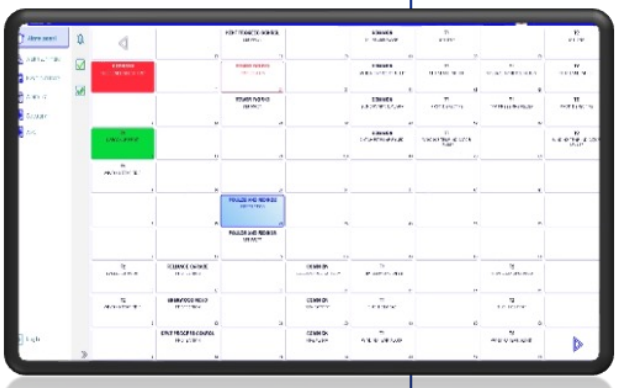
Customisable

The tool is organised for plugin to offer the maximum level of customization; **Multiple Single Line Diagrams** are supported, and may contain labels, images, and symbols to represent a complex electrical grid network. The operator always has complete access to the SLDs using the **multi TAB interface** from any location in the system. The **WebHMI Editor**, an in-built configuration tool provided with the application, permits the creation of dynamic and customisable vector graphic symbols and labels, allowing the user to create all types of customised displays as required.

Security Dashboard Plugin offers to the user an easy to read graphical dashboard that summarise the security events/incidents creating an irreplaceable tool for security plans and security audits.

Secure

The architecture is **HTML5** based and only allows **HTTPS** secure client/server communications with access granted exclusively to authorised users. It supports centralised access management servers using **LDAPS** and **Two Factor Authentication**; current user data is accessible from the main screen. **WebHMI** is continually security tested having **advanced penetration tests** regularly carried out **by certified third-party companies**.



Conclusions

The **ZIV WebHMI** contains all the necessary features for monitoring and control. It is the next step forward in efficient substation management.

Technical Information

Communications Interfaces	
Ethernet	• 2 x 10/100Base-TX (RJ-45 connections)
Serial Ports	• 4 x RS-232/485 (9 way Male D-Type) • 1 x USB Port • 1 x GPS Integrated Clock (Optional)
Number of I/O Modules	• 5, 8 or 12 I/O module variants are available (Plug & Play)
Power Supply Module	
Input Voltage Range	• 8-72 VDC or 36-150VDC
Power Consumption	• Typically < 4W (refer to specific module datasheets) – Power Supply Rating 24W
Fault & Disturbance Functionality	
Directional Fault Indications	• Directional/ Non-Directional Fault detection (ANSI 67, 67N,50/51, 50N/51N)
Disturbance Recording	• Under-voltage / Over-voltage detection (ANSI 27, ANSI 59)
Voltage Presence/Absence detection	• Undercurrent Detection (ANSI 37)
Fault Current Detection/Indication	• LV Power quality -- Voltage dip / swell / interruption start / duration
Broken Conductor detection (ANSI 47)	• LV Power quality -- Current unbalanced variation
DER Functionality	
Net Power Flow Management (Import/Export) Voltage Management PQ Envelope Management Hardwired / Serial DER Setpoint Controls Control-Feedback confirmation)	• Failsafe Operation (Hold, Pre-set, Disconnect • Local Operator Panel available (Push-button / HMI) • Multi-Master Station support (SCADA / ANM) • Multi-Protocol Support • Flexible measurement collection (Direct / Serial)
Other Functionality	
Cybersecure (TLSv1.3, IPSEC VPN, Secure LDAP, Radius, Secure SCADA Protocols, Signed Software/Hardware, Secure Syslog, …)	• Secure Web Server HMI with complete substation line diagrams (option) • IEC-61131 User Programming Application • IED & SCADA Protocols (>70 Protocols incl. IEC 61850) • Programmable Firewall (option)

Technical Information

DI Digital Input Module (multiple modules supported)	
Inputs	• 16 (one common for each 8 inputs)
Input Voltage	• 18-72 VDC or 36-150 VDC (Specified at time of order)
DO Digital / Control Output Module (multiple modules supported)	
Outputs	• 8 (Form A) normally open single pole outputs
Switching Current	• 5 A @ 250 VAC, 5 A @ 30 VDC 0.5 A @ 125 VDC
AC Measurement Module (multiple modules supported)	
Inputs	• 4 Current and 3 Voltage
Interface	• CT/VTs; LEA (Low Energy Analogues); Rogowski; Line Post; Other low voltage input ranges
Measurements	• V, I, Freq, MW, Mvar, PF
DC Measurement Module (multiple modules supported)	
Inputs	• 8
Nominal Range	• 0-1V, 0-10VDC, ±1V, ±5V, 10V, 20mA, 4-20mA
AO Analogue Setpoint Module (multiple modules supported)	
Outputs	• 4
Range	• Configurable between +/- 20mA

Environmental Conditions	
Temperature Continuous Operation	• -20° to +70 °C standard - IEC 60068-2-1 & IEC 60068-2-2
Transport and Storage	• -40° to +85 °C
Relative Humidity	• 0 to 95% non-condensing - IEC 60068-2-3 & IEC 60068-2-78
Vibration	• IEC 60068-2-6 & 60255-21-1 Class 2
Drop & Shock	• IEC 60068-2-31

Dimensions & Mounting	
Dimensions (W * H * D)	• 5 I/O Slots: 174 mm (W) x 136 mm (H) x 135 mm (D) (201 mm (W) incl. rear mounting flanges) • 8 I/O Slots: 235 mm (W) x 136 mm (H) x 135 mm (D) (262 mm (W) incl. rear mounting flanges) • 12 I/O Slots: 317 mm (W) x 136 mm (H) x 135 mm (D) (344 mm (W) incl. rear mounting flanges)

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