DCS Fieldbus Modules for APACS+™ Automation Systems

I/A Series® system Field Control Processor 270 (FCP270) modules mounted on a baseplate and distributed control system (DCS) Fieldbus Modules replace the APACS+ Control and I/O modules and connect existing field devices to the I/A Series system via a 2 Mbps HDLC Fieldbus and high-speed Ethernet network.

FEATURES
- Migration from proprietary DCS to a state-of-the-art open I/A Series system.
- Advanced I/A Series control with a single point of configuration.
- More direct control performance than any gateway device could offer.
- Cost savings over total system replacement by preserving the existing process interface and wiring and minimizing process downtime.
- Single vendor service and supply.

OVERVIEW
The I/A Series system DCS Fieldbus Modules (FBMs) are for migration of APACS+™ automation systems manufactured by Siemens® Energy & Automation, Inc. and Moore Products Co. The FBMs plug directly into an existing electronic nest to replace process input and output modules.
The I/A Series system DCS FBM family provides a migration path from APACS+ process I/O components to I/A Series display and supervisory functions. No additional communication devices are required. No multi-vendor communication software licensing is required.

The I/A Series system DCS FBM family replaces the APACS+ I/O modules. Once integrated, the process is controlled entirely by the advanced I/A Series algorithm set.

The I/A Series system DCS FBM product includes connectors to enable integration of original process signals to I/A Series systems while keeping the field interface and wiring. It provides access to all process signals connected to the APACS+ system by providing the connection between the Field Termination Assemblies (FTAs) and the I/A Series system. All process signals become fully integrated into the I/A Series system through the use of process data for operator display, history, alarming and control.

Operator functions and engineering configuration are accomplished by the I/A Series system at any I/A Series operator workstation. Because all process values become part of the I/A Series system, all configuration data is maintained by the system as native I/A Series configurations.

This migration path provides plant operations with all the power and flexibility of the I/A Series system.

**FUNDAMENTAL PRINCIPLE**

Invensys believes that it is only acceptable to interface with competing manufacturers’ operating systems in two ways:

- Through high level public gateways
- At the lowest level directly to field devices without communicating with proprietary buses or components.

The Invensys migration product offerings adhere to this principle.

**PRODUCT DESCRIPTIONS**

The I/A Series migration strategy replaces the APACS+ process control system with a 2 Mbps Fieldbus connection to an I/A Series system Field Control Processor 270 (FCP270), provides a module-for-module replacement of I/O modules, but leaves the original process interface wiring and cabinets in place.

To replace the APACS+ control and I/O modules mounted in MODULRAC, SIXRAC or UNIRAC assemblies, the APACS+ migration consists of new I/A Series system DCS FBMs, FCP270 and baseplate. The baseplate supports either a single FCP270 module or a pair of fault-tolerant FCP270 modules. The FCP270 provides the control algorithms and interface between the FBMs and the 100 Mbps/1 Gbps Ethernet control network. This allows migration to I/A Series control, display and application products while retaining the original process termination and field I/O wiring. All original process I/O capability of the APACS+ module functions is replaced by FBMs and direct I/A Series control processor scanning and control. For more information on the FCP270, refer to PSS 21H-1B9 B3.

Using the I/A Series system Z-Module Control Processor 270 (ZCP270) instead of the FCP270 requires a new I/A Series system Z-module mounting structure that mounts in a 19 inch rack, Fieldbus Communications Module (FCM100Et and FCM100E), and baseplate. A single or redundant pair of FCM100Et/FCM100E modules mounts on the baseplate.
The FCM100Et/FCM100E provides the interface between the FBMs, via a 2Mbps HDLC Fieldbus, and the ZCP270 controller, via a 100Mbps Ethernet Fieldbus. For more information on the ZCP270, refer to PSS 21H-1B10 B3. For more information on the FCM100Et, refer to PSS 21H-2Y10 B4. For more information on the FCM100E, refer to PSS 21H-2Y11 B4.

New I/A Series system DCS FBMs plug directly into existing MODULRACs, SIXRACS or UNIRACs in place of APACS+ I/O modules.

The Fieldbus connects the DCS FBM subsystem to the FCP270 or ZCP270. I/O from the subsystem is connected to the control strategy using standard I/A Series system I/O type blocks. The DCS FBMs pass process measurement and output signals and digital I/O signals to and from the control processor.

All process signals are fully integrated into the I/A Series system, allowing direct I/A Series system monitoring and control of the process.

Migration using either the FCP270 or FCM100Et/FCM100E and baseplate is accomplished using the DCS Fieldbus Module Migration Kit (P0922TL).

**APACS+ Subsystems**

An FCP270 or FCM100Et/FCM100E baseplate is installed in the MODULPAC enclosure with single or redundant modules. The baseplate has a built-in Fieldbus termination assembly. The I/O module power supplies and MODULRACs are retained in the cabinet.

The MODULRACS, used to house I/O modules, are reused to house the I/A Series system DCS FBMs. All termination assemblies in the local, adjacent, and remotely marshalled MODULPACs remain intact with their termination cables and field wiring.

APACS+ I/O modules are removed from the MODULRAC and replaced by a corresponding I/A Series system DCS FBM that mates to the original power/signal connector and termination cable connector on the back of the MODULRAC. This DCS FBM provides original I/O functionality of the process inputs and outputs.

**Ladder Logic Implementation**

Ladder logic for an APACS+ system is implemented in the ACM controllers, not in the I/O modules. Thus, any digital I/O point in the system can be used as an input or output to the ladder logic running in the ACM. A similar capability exists with the migrated APACS+ system through the use of sequence control logic in the FCP270 or ZCP270 Control Processor.

Invensys ladder logic is implemented by using a combination of logic which executes directly in the digital I/O modules and sequence control logic in the Control Processor. This same capability exists in the AID115, AID230, AOD115, and ADO125 APACS+ migration modules. The channel configurable ASAM01, AEAM01, ASDM24 and ASDM48 I/O modules implement ladder logic only by using sequence control logic in the Control Processor similar to the original APACS+ system.

**Migration with FCP270 and DCS FBMs**

The Field Control Processor 270 (FCP270) is a distributed, field-mounted controller module that supports up to 39 DCS FBMs. The FCP270 connects to the control network via optionally redundant 100 Mbps Ethernet fiber optic cables and Ethernet fiber switches. The FCP270 is an optionally fault-tolerant controller that communicates with connected DCS FBMs to perform data acquisition and control using I/A Series control algorithms.

The FCP270 mounts in a 2-position baseplate that supports a single module or a fault-tolerant module pair. The baseplate accepts only FCP270 modules. The FCP270 connects to an optionally redundant 2 Mbps HDLC I/O Fieldbus for communications to
the DCS FBMs and provides galvanic isolation between the 100 Mbps Ethernet Fieldbus and the 2 Mbps local Fieldbus.

Fault-tolerant FCP270 modules connect to a pair of fiber optic splitter/combiners that connect to Ethernet switches in a redundant control network. The splitter/combiner pair mounts in an assembly that fastens to the baseplate.

To support redundancy, a pair of FCP270s must be used for each DCS FBM grouping. In non-redundant configurations, only a single FCP270 is required for each grouping.

The maximum total cable length for the 2 Mbps Fieldbus is 60 m (198 ft) within a grouping.

Migration with FCM100Et/FCM100E and DCS FBMs

The FCM100Et and FCM100E are fiber optic communications interfaces which allow the DCS FBMs to communicate with the ZCP270 via the optionally redundant 100 Mbps Ethernet fiber optic Fieldbus. The FCM100Et and FCM100E convert 100 Mbps Ethernet signals used by the ZCP270 to 2 Mbps signals used by the DCS FBMs, and vice versa. The FCM100Et and FCM100E also provide galvanic isolation between the 100 Mbps Ethernet Fieldbus and the 2 Mbps local Fieldbus.

The FCM100Ets/FCM100Es are used in pairs for redundancy. A single or pair of FCM100Ets/FCM100Es can support up to 39 DCS FBMs. The ZCP270 supports up to 32 FCM100Ets/FCM100E redundant pairs connected to the 100 Mbps Ethernet Fieldbus via optionally redundant Ethernet switches and fiber optic cabling. The ZCP270 supports up to 120 DCS FBMs connected to FCM100Ets/FCM100Es.

The FCM100Et and FCM100E allow the DCS FBMs to communicate with the ZCP270 over extended distances using the 100Mbps Ethernet fiber optic Fieldbus. The FCM100Et and FCM100E provide expanded networking and greater Fieldbus cabling distances in a fiber optic network. This configuration is ideally suited for sites in which groups of DCS FBMs are to be spread apart over greater distances. Up to 32 groupings of baseplate-mounted FCM100Ets/FCM100Es and DCS FBMs can be linked to each optionally redundant Ethernet switch, for a maximum of 120 DCS FBMs per ZCP270 (depending on selected scan periods).

To support redundancy, a pair of FCM100Ets or FCM100Es must be used for each DCS FBM grouping. In non-redundant configurations, only a single FCM100Et or FCM100E is required for each grouping. Signal transmission distances up to 2 kilometers (1.24 miles) are possible between the FCM100Ets/FCM100Es and Ethernet fiber switches, providing for wide distribution of the DCS FBM equipment groupings. The maximum total cable length for the 2 Mbps Fieldbus is 60 m (198 ft) within a grouping.

I/O Modules

The DCS FBMs provide advanced 200 Series FBM technology on an APACS+ module form factor. Each DCS FBM plugs into the slot used by the replaced APACS+ module and provides two rear connectors, one of which mates to a connector on a local field termination strip on the backplane of the MODULRAC.

For marshalled termination assembly located in an adjacent MODULPAC enclosure, the DCS Fieldbus Module I/O connector mates to a field termination cable connector mounted on the back of the MODULRAC.

The following I/O module types are used in the APACS+ system:
- Analog input module
- Analog multi-range input module
- Analog RTD input module
- Digital input module
- Digital output module
- HART® input module
- HART redundant input module
- Analog/digital/pulse input and analog/digital output module, configurable point-by-point

Each module type is replaced with an equivalent I/A Series system DCS FBM module. All I/O wiring connected to the I/O module termination strips remain in place. Power is derived from the original rack power supply. Table 1 lists the available DCS Fieldbus Modules and the APACS+ modules they replace.

### Table 1. DCS Fieldbus Modules I/O Options

<table>
<thead>
<tr>
<th>DCS FBM</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Replaces APACS+ Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEAM01</td>
<td>1-16 AI/DO/DI/P*</td>
<td>1-16 AO/DO*</td>
<td>EAM</td>
</tr>
<tr>
<td>ART203</td>
<td>16 AI RTD</td>
<td>None</td>
<td>RTM</td>
</tr>
<tr>
<td>ASAM01</td>
<td>1-32 AI/DO/DI/P*</td>
<td>1-32 AO/DO*</td>
<td>SAM</td>
</tr>
<tr>
<td>AVI202</td>
<td>16 AI (multirange)</td>
<td>None</td>
<td>VIM</td>
</tr>
<tr>
<td>ASA211</td>
<td>32 AI</td>
<td>None</td>
<td>SAI</td>
</tr>
<tr>
<td>ASDM24</td>
<td>1-32 DI (24 V dc)*</td>
<td>1-32 DO (24 V dc)*</td>
<td>SDM (24 V dc)</td>
</tr>
<tr>
<td>ASDM48</td>
<td>1-32 DI (48 V dc)*</td>
<td>1-32 DO (48 V dc)*</td>
<td>SDM (48 V dc)</td>
</tr>
<tr>
<td>AID115</td>
<td>32 DI (115 V ac)</td>
<td>None</td>
<td>IDM115</td>
</tr>
<tr>
<td>AID230</td>
<td>32 DI (230 V ac)</td>
<td>None</td>
<td>IDM230</td>
</tr>
<tr>
<td>AOD115</td>
<td>None</td>
<td>32 DO (115 V ac)</td>
<td>ODM</td>
</tr>
<tr>
<td>ADO125</td>
<td>None</td>
<td>16 DO (125 V dc)</td>
<td>IDO</td>
</tr>
<tr>
<td>AHF214</td>
<td>16 AI (HART)</td>
<td>None</td>
<td>HFM</td>
</tr>
<tr>
<td>AHF216</td>
<td>16 AI (HART)</td>
<td>None</td>
<td>HFM (redundant)</td>
</tr>
</tbody>
</table>

* Configurable point-by-point.
FUNCTIONAL SPECIFICATIONS – COMMON TO ALL MODULES

Communication
The DCS Fieldbus Modules communicate with the associated FCP270 or FCM100Et/FCM100E via the local 2 Mbps Fieldbus.

Calibration Requirements
Calibration of the modules is not required.

Power Requirements

**INPUT VOLTAGE RANGE (REDUNDANT)**
24 V dc +5% to -10%

**Power Monitoring**
Primary and backup rack power sources are monitored and alarmed at the system level if either voltage drops below acceptable levels.

Regulatory Compliance

**ELECTROMAGNETIC COMPATIBILITY (EMC)**
- European EMC Directive 89/336/EEC
- Meets: EN 50081-2 Emission standard
- EN 50082-2 Immunity standard
- EN 61326 Annex A (Industrial Levels)
- CISPR 11, Industrial, Scientific and Medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement
- Meets Class A Limits

**ELECTROMAGNETIC COMPATIBILITY (CONT.)**
- IEC 61000-4-2 ESD Immunity
  - Contact 8 kV, air 15 kV
- IEC 61000-4-3 Radiated Field Immunity
  - 10 V/m at 80 to 1000 MHz
- IEC 61000-4-4 Electrical Fast Transient/Burst Immunity
  - 2 kV on I/O and communication lines
- IEC 61000-4-5 Surge Immunity
  - 2kV on ac and dc power lines; 1kV on I/O and communications lines
- IEC 61000-4-6 Immunity to Conducted Disturbances induced by radio-frequency fields
  - 3 V (rms) at 150 kHz to 80 MHz on I/O and communication lines
- IEC 61000-4-8 Power Frequency Magnetic Field Immunity
  - 30 A/m at 50 and 60 Hz
ADO125 DISCRETE OUTPUT FUNCTIONAL SPECIFICATIONS

Output
16 individually isolated channels

Minimum Module Scan Time
10 ms

Power Requirements

POWER CONSUMPTION
6 W maximum

HEAT DISSIPATION
8 W maximum (27 BTU/hr)

Output Applied Voltage
24 to 125 V dc (130 V dc maximum)

Output Load Current
2 A at 24 V dc or 0.5 A at 125 V dc maximum
50 mA minimum (100 mA for redundant)
20 A maximum per module
< 10 A surge for 10 ms

On-State Voltage Drop
< 2.5 V dc at 2 A (includes drop in 3 m cable)

Off-State Leakage Current
< 4 mA

Fusing
1 fuse per point on marshalled terminal assembly
(2 A 250 V dc slowblow cartridge type).
4 A thermal and 1 electronic (resetable) per point in
module. The thermal fuses are protected from
nuisance blowing by the electronic soft fuse which
blows prior to 3 A.

Channel Isolation
Each channel is galvanically isolated from all other
channels and earth (ground). The module withstands,
without damage, a potential of 600 V ac applied for
one minute between any channel and ground and
600 V ac between any channel and all other
channels.

CAUTION
The channel isolation statement does not
imply that these channels are intended for
permanent connection to voltages of these
levels. Exceeding the limits for input
voltages, as stated elsewhere in this
specification, violates electrical safety codes
and may expose users to electric shock.

AEAM01 ANALOG/DISCRETE/PULSE I/O FUNCTIONAL SPECIFICATIONS

Input/Output
16 individually isolated channels, software
configurable on a per channel basis, as listed below.

ANALOG INPUT
Current input range: 0 to 20 mA or 4 to 20 mA
Voltage input range: 0 to 5 V dc or 1 to 5 V dc
Resolution: 15 bits
Accuracy: ±0.03% of span

ANALOG OUTPUT
Current output range: 0 to 20.4 mA
Resolution: 13 bits
Accuracy: ±0.05% of span

FREQUENCY INPUT
Range: 10 to 50000 Hz
Resolution: 15 bits
Accuracy: ±0.01% of reading
Pulse count: no missing pulses
Minimum pulse width: 6 µs

FREQUENCY INPUT (CONTINUED)
Current input threshold: 10 mA ±1 mA
Voltage regular threshold: 2.5 V dc ±0.125 V dc
Voltage TTL threshold: 1.4 V dc ±0.125 V dc

DISCRETE INPUT SOURCING
Input filter delay: 5.6 ms maximum
Input wetting current: 20 mA

DISCRETE INPUT SINKING
Input filter delay: 11 ms maximum

DISCRETE OUTPUT
Maximum output current: 40 mA
On-state voltage range: 14 to 24 V dc
Off-state leakage current: < 0.05 mA

Minimum Module Scan Time
25 ms for inputs
10 ms for outputs
**Power Requirements**

**POWER CONSUMPTION**
17 W maximum

**HEAT DISSIPATION**
17 W maximum (58 BTU/hr)

**Channel Isolation**

Each channel is galvanically isolated from all other channels and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any channel and ground and 600 V ac between any channel and all other channels.

**CAUTION**

The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

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**AHF214/216 HART INPUT FUNCTIONAL SPECIFICATIONS**

**Input**

16 group isolated channels with 1 to 5 V dc and HART Protocol communications Single Drop capability only.

- Point-to-point, master slave asynchronous, half duplex at 1200 baud
- Error checking – parity on each byte and one CRC byte
- Speed – 2 messages per second

Input range: 0 to 5.12 V dc (0.0 to 20.48 mA at marshalled termination assembly)
Calibration range (span): 1 to 5 V dc
Input overvoltage: ±30 V dc (continuous)
Input accuracy: ±0.1% of span
Input resolution: 15 bits
Analog update rate: 100 ms

**Power Requirements**

(All transmitters powered from the migration module.)

**POWER CONSUMPTION**
10 W maximum

**HEAT DISSIPATION**
10 W maximum (34 BTU/hr)

**Channel Isolation**

The module withstands, without damage, a potential of 600 V ac applied for one minute between all channels and ground.

**CAUTION**

The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.
AID115 DISCRETE INPUT FUNCTIONAL SPECIFICATIONS

Discrete Input
32 channels in 8 groups of 4 channels. Each group is isolated from the other groups and ground. Each group may be connected to a separate ac supply.

Input operating voltage range: 84 to 140 V ac, RMS
Frequency: 47 to 63 Hz
Input delay filter time: 22 ms typical
Minimum input (wetting) current: 3.1 mA RMS, 5.6 mA peak at 115 V ac
Logic “0” state input voltage: 0 to 71 V ac RMS, 50/60 Hz
Logic “0” state input current: 0.0 to 0.56 mA RMS
Logic “1” state input voltage: 84 to 140 V ac RMS, 50/60 Hz
Logic “1” state input current: 1.6 to 6.3 mA RMS

Power Requirements
POWER CONSUMPTION
3 W maximum
HEAT DISSIPATION
16 W maximum (55 BTU/hr)

Channel Isolation
Each group of channels is galvanically isolated from all other groups and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any group of channels and ground and 600 V ac between any group and all other groups.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

AID230 DISCRETE INPUT FUNCTIONAL SPECIFICATIONS

Discrete Input
32 channels in 8 groups of 4 channels. Each group is isolated from the other groups and ground. Each group may be connected to a separate ac supply.

Input operating voltage range: 182 to 250 V ac, RMS
Frequency: 47 to 63 Hz
Input delay filter time: 22 ms typical
Minimum input (wetting) current: 2.17 mA RMS, 3.84 mA peak at 230 V ac
Logic “0” state input voltage: 0 to 150 V ac RMS, 50/60 Hz
Logic “0” state input current: 0.0 to 0.56 mA RMS
Logic “1” state input voltage: 182 to 250 V ac RMS, 50/60 Hz
Logic “1” state input current: 1.44 to 3.38 mA RMS

Power Requirements
POWER CONSUMPTION
3 W maximum
HEAT DISSIPATION
20 W maximum (68 BTU/hr)

Channel Isolation
Each group of channels is galvanically isolated from all other groups and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any group of channels and ground and 600 V ac between any group and all other groups.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.
AOD115 DISCRETE OUTPUT FUNCTIONAL SPECIFICATIONS

Discrete Output
32 channels in 4 groups of 8 channels. Each group is isolated from the other groups and ground. Each group may be connected to a separate ac supply.

Output operating voltage range: 93 to 132 V ac, RMS
AC supply current: 30 A maximum
Frequency: 47 to 63 Hz
Output current per channel: 1.0 A maximum, 0.033 A minimum
Total output current (all channels): 4 A per group maximum, 16 A per module maximum at 30 °C
Output (group) fuse rating: 5 A, 250 V ac
Output voltage drop: 1.82 V ac maximum
Surge current: 25 A maximum for 16.6 ms (1 cycle), 17 A maximum for 33 ms (2 cycles)
Off-state channel leakage current: 4 mA maximum

Channel Isolation
Each group of channels is galvanically isolated from all other groups and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any group of channels and ground and 600 V ac between any group and all other groups.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

Power Requirements

**POWER CONSUMPTION**
11 W maximum

**HEAT DISSIPATION**
24 W maximum (82 BTU/hr)

ART203 RTD INPUT FUNCTIONAL SPECIFICATIONS

Input
16 software configurable, individually isolated RTD or slidewire channels
Input rangesa: 0 to 320 Ω (100 Ω Pt or Ni), 0 to 640 Ω (200 Ω Pt) or 5 to 1005 Ω slidewire
Lead resistance: 50 Ω maximum each leadb
Accuracy: ±0.03% of span, temperature coefficient ±50 ppm/°C

a320 Ω equals 64000 counts. Minimum overrange value is 327.675 Ω at a count of 65535.
640 Ω equals 64000 counts. Minimum overrange value is 655.35 Ω at a count of 65535.
1280 Ω equals 64000 counts. Minimum overrange value is 1310.7 Ω at a count of 65535.
bAny imbalance in extension leads will decrease accuracy.

Module Scan Time

<table>
<thead>
<tr>
<th>Integration Period (ms)</th>
<th>Update Time (ms)</th>
<th>Settling Time* (ms)</th>
<th>Resolution (bits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>25</td>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td>100</td>
<td>25</td>
<td>125</td>
<td>15</td>
</tr>
<tr>
<td>250</td>
<td>25</td>
<td>200</td>
<td>15</td>
</tr>
<tr>
<td>500</td>
<td>25</td>
<td>500</td>
<td>15</td>
</tr>
<tr>
<td>1000</td>
<td>25</td>
<td>1000</td>
<td>15</td>
</tr>
</tbody>
</table>

* Value settles within a 1% band of steady state for an input step change of 30 to 320 Ω.
ART203 RTD INPUT FUNCTIONAL SPECIFICATIONS (CONT.)

Power Requirements

POWER CONSUMPTION
6 W maximum

HEAT DISSIPATION
6 W maximum (20 BTU/hr)

Channel Isolation
Each channel is galvanically isolated from all other channels and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any channel and ground and 600 V ac between any channel and all other channels.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

ASA211 ANALOG INPUT FUNCTIONAL SPECIFICATIONS

Input
32 group isolated analog channels.

Input range: 0.0 to 5.12 V dc (0.0 to 20.48 mA at marshalled termination assembly)
Calibration range (span): 1 to 5 V dc (4 to 20 mA at termination assembly)
Resolution: 15 bits
Accuracy: ±0.1% of span over 4 to 20 mA range
Temperature Effect: ±100 ppm/°C

Minimum Module Scan Time
50 ms

Power Requirements

POWER CONSUMPTION
3 W maximum

HEAT DISSIPATION
3 W maximum (10 BTU/hr)

Channel Isolation
The channels are galvanically isolated from earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between all channels and ground.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.
ASAM01 ANALOG/DISCRETE INPUT/OUTPUT FUNCTIONAL SPECIFICATIONS

Input/Output
32 group isolated channels, software configurable on a per channel basis, as listed below.

**ANALOG INPUT**
- Current input range: 0 to 20.48 mA
- Calibration range: 4 to 20 mA
- Resolution: 15 bits
- Accuracy: ±0.1% of span over 4 to 20 mA range

**ANALOG OUTPUT**
- Current output range: 0.1 to 20.48 mA
- Calibration range: 4 to 20 mA
- Resolution: 13 bits
- Accuracy: ±0.1% of span over 4 to 20 mA range
- Load capacity: 50 to 800 \(\Omega\)

**DISCRETE INPUT (CONTACT TYPE)**
- Current supplied: 10 mA
- Minimum on-state percentage: 0 to 100% configurable, scale from 0 to 10 mA
- Minimum off-state percentage: 0 to 100% configurable, scale from 0 to 10 mA
- Default configuration: > 8 mA for input On
- Default configuration: < 2 mA for input Off

**DISCRETE OUTPUT**
- Output On (load < 856 \(\Omega\)): 20.48 mA maximum
- Output On (load > 856 \(\Omega\)): 20.2 V dc minimum
- Output Off: 0.1 mA maximum, 0.0 mA minimum

**Minimum Module Scan Time**
- 50 ms for inputs
- 10 ms for outputs

**Power Requirements**
- **POWER CONSUMPTION**
  - 24 W maximum
- **HEAT DISSIPATION**
  - 24 W maximum (41 BTU/hr)

**Channel Isolation**
The channels are galvanically isolated from earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between all channels and ground.

**CAUTION**
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.
ASDM24 DISCRETE INPUT/OUTPUT FUNCTIONAL SPECIFICATIONS

Input/Output
32 group isolated channels, configurable on a per channel basis as discrete input, discrete output, or pulse output.

DISCRETE INPUT (CONTACT TYPE)
Current supplied: 9.9 mA at 24 V dc typical
On-state voltage range: 19.0 to 30.0 V dc
Maximum off-state current: 6 mA
Off-state voltage range: -0.5 to 15 V dc

DISCRETE OUTPUT
Output current per channel: 600 mA maximum
Output surge current: 2.0 A maximum for 10 ms
Output fuse rating: 2.0 A (not field-replaceable)
Output current total: see following table
Off-state leakage current: 1.6 mA maximum

Minimum Module Scan Time
10 ms

Power Requirements
POWER CONSUMPTION
5 W maximum
HEAT DISSIPATION
12 W maximum (41 BTU/hr)

Fusing
2 A thermal and 1 electronic (resetable) per point in module. The thermal fuses are protected from nuisance blowing by the electronic soft fuse which blows prior to 1 A.

Channel Isolation
The channels are galvanically isolated from earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between all channels and ground.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>0.6 A</th>
<th>0.5 A</th>
<th>0.4 A</th>
<th>0.3 A</th>
<th>0.2 A</th>
<th>0.1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°C (86°F)</td>
<td>19 (11.4 A total)</td>
<td>24 (12.0 A total)</td>
<td>32 (12.8 A total)</td>
<td>32 (9.6 A total)</td>
<td>32 (6.4 A total)</td>
<td>32 (3.2 A total)</td>
</tr>
<tr>
<td>35°C (95°F)</td>
<td>15 (9.0 A total)</td>
<td>19 (9.5 A total)</td>
<td>27 (10.8 A total)</td>
<td>32 (9.6 A total)</td>
<td>32 (6.4 A total)</td>
<td>32 (3.2 A total)</td>
</tr>
<tr>
<td>45°C (113°F)</td>
<td>10 (6.0 A total)</td>
<td>13 (6.5 A total)</td>
<td>18 (7.2 A total)</td>
<td>27 (8.1 A total)</td>
<td>32 (6.4 A total)</td>
<td>32 (3.2 A total)</td>
</tr>
<tr>
<td>60°C (140°F)</td>
<td>4 (2.4 A total)</td>
<td>5 (2.5 A total)</td>
<td>8 (3.2 A total)</td>
<td>12 (3.6 A total)</td>
<td>21 (4.2 A total)</td>
<td>32 (3.2 A total)</td>
</tr>
</tbody>
</table>
ASDM48 DISCRETE INPUT/OUTPUT FUNCTIONAL SPECIFICATIONS

Input/Output
32 group isolated channels, configurable on a per channel basis as discrete input, discrete output, or pulse output.
- Off-state leakage current: 1.6 mA maximum

DISCRETE INPUT (CONTACT TYPE)
- Current supplied: 9.9 mA at 48 V dc typical
- On-state voltage range: 19.0 to 30.0 V dc
- Maximum off-state current: 6 mA
- Off-state voltage range: 0 to 15 V dc

DISCRETE OUTPUT
- Output current per channel: 600 mA maximum
- Output surge current: 2.0 A maximum for 10 ms
- Output fuse rating: 2.0 A (not field-replaceable)
- Output current total: see following table
- Off-state leakage current: 1.6 mA maximum

Minimum Module Scan Time
10 ms

Power Requirements
- POWER CONSUMPTION
  4 W
- HEAT DISSIPATION
  15 W maximum (51 BTU/hr)

Fusing
2 A thermal and 1 electronic (resetable) per point in module. The thermal fuses are protected from nuisance blowing by the electronic soft fuse which blows prior to 1 A.

Channel Isolation
The channels are galvanically isolated from earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between all channels and ground.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>Number of Channels at Specified Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.6 A</td>
</tr>
<tr>
<td>30°C (86°F)</td>
<td>19 (11.4 A total)</td>
</tr>
<tr>
<td>35°C (95°F)</td>
<td>15 (9.0 A total)</td>
</tr>
<tr>
<td>45°C (113°F)</td>
<td>10 (6.0 A total)</td>
</tr>
<tr>
<td>60°C (140°F)</td>
<td>4 (2.4 A total)</td>
</tr>
</tbody>
</table>
AVI202 ANALOG OR THERMOCOUPLE INPUT FUNCTIONAL SPECIFICATIONS

Input
16 individually isolated channels software configurable, on a per channel basis, for thermocouple or voltage input.

VOLTAGE INPUTS
Ranges (V dc): -10 to +10, -5 to +5, -1 to +1, -100 to +100 mV, 0 to +5, and +1 to +5
Input overvoltage protection: ±30 V dc
Accuracy: ±0.1% of span

THERMOCOUPLE INPUTS
Isothermal sense accuracy: ±0.5°C
Linearity: Included in Accuracy
Accuracy: ±27 µV at 25°C
Accuracy temperature coefficient: ±50 PPM/°C
Conformity: ±0.25°C
Thermocouple junction type: grounded or ungrounded

Power Requirements
POWER CONSUMPTION
6 W maximum
HEAT DISSIPATION
6 W maximum (20 BTU/hr)

Channel Isolation
Each channel is galvanically isolated from all other channels and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any channel and ground and 600 V ac between any channel and all other channels.

CAUTION
The channel isolation statement does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.