solartron

3595 Series

IMP

Isolated Measurement Pods

IMP

Industrial Plant Monitoring that's out on its own...

Contents

Solartron's IMP family presents the complete solution to your distributed measurement problems.

The IMP concept is simple: plant parameters - such as temperature, strain, vibration, etc. - are measured at source by intelligent data acquisition modules (IMPs). Every IMP (Isolated Measurement Pod) is linked on a low cost network (carrying control, data *and* power) to a host computer which controls the IMPs and stores and displays the measured data where it is needed - in the control room, on the shop floor, or at any other strategic location.

The IMP system gives you precisely the information you need to control and monitor your plant, with maximum reliability, maximum flexibility and at very competitive cost.

Precise... IMPs offer accurate, high precision (16-bit) measurements with excellent noise immunity and common mode isolation, even in areas of high electrical interference and vibration. In-built facilities enhance measurements on thermocouples, PRTs and strain gauges.

Reliable... With an operating temperature range of -20°C to +70°C (-4°F to +158°F) even at 95% humidity, and a rugged housing meeting IP55 / NEMA 4 standards, IMPs are built to work under harsh conditions. Whether your plant is hot, dirty, cold or wet - or all four! - we offer a full 3-year warranty on every IMP.

Flexible... Installing the 2-wire multi-drop network (S-Net) couldn't be simpler, and modifications can be made in minutes. IMPs can be rapidly added or removed when required, without the need for extensive rewiring.

IMP systems can range from a few IMPs on a single S-Net to multiple networks with many thousands of channels.

Cost effective... IMPs contain everything you require for precise, reliable data acquisition. What you get is all you need - there's no necessity for expensive signal conditioning, filters, amplifiers, transducer wiring, vibration mounts, environmental packaging, special power supplies or expensive network hardware. There are no hidden costs with IMPs!

With over 30,000 IMPs in operation throughout the world, in daily use by many of the world's most successful companies (see box), there is no doubt that Solartron's IMP family is out on its own...

Some typical IMP monitoring applications...

● Feedwater boiler temperature ● Temperatures and pressures around nuclear reactors ● Bearing temperatures of steam turbines ● Smoke detection and temperature in the Channel Tunnel ● Water pollution ● Gamma rays at power station perimeters ● Temperature, humidity and flow in pharmaceutical clean rooms ● Temperatures to increase the efficiency of car tyre manufacture ● Process plant.

Typical users include:

Ansaldo, Beijing Electric Power Research
British Steel, Duke Power
Electricité de France, ENEL
Florida Power & Light, National Grid
Nuclear Electric, Philadelphia Electric
PowerGen, Scottish Nuclear
Scottish Power, UES Steels

Coming to terms with the technology

IMP (**I**solated **M**easurement **P**od) is a complete data acquisition module containing: signal conditioning, 16 bit ADC, communications to host computer, built-in sensor energization and a detachable connector block, all housed in a NEMA 4 / IP55 environmentally protected case and built to ISO 9001 standards.
IMPs can make precise measurements of dc voltage, current, temperature (direct from thermocouples or PRTs), resistance, 4-20mA signals, strain, vibration, pressure, frequency, pulse counts, events and status, under the control of the internal processor, as directed by commands from the host computer.

IMC (**I**solated **M**easurement **C**ard) All IMPs are available without the NEMA 4 packaging, suitable for high channel count monitoring in less demanding environments, such as a control room, for example.

VIMP (**V**ibration **I**solated **M**easurement **P**od) is dedicated to surveillance monitoring of rotating plant. The VIMP is a 16 or 32 channel FFT spectrum analyser with signal conditioning and scanning built in.
It is ideal for predictive maintenance applications and offers the unique opportunity to combine static data from IMPs and dynamic data (from VIMPs) on the *same* network. Refer to the separate VIMP brochure for full details.

VIM (**V**ibration **I**nterface **M**odule) enables vibration signals to be integrated with process data, for cost-effective on-line vibration monitoring. *See brochure B359507 for details.*

S-Net is our high speed industrial digital communications network that is used for control, power and data communications with IMPs, IMCs and VIMPs to the host computer. A single S-Net can be up to 1.5km (1 mile) long, with up to 50 IMPs multi-dropped along its length.
It provides excellent noise rejection with transparent error correction, and can handle up to 1,000 channels per second. S-Net cable needs only two conductors, giving low cost installation and maintenance.

Ethernet With the increasing use of Ethernet as a plant-wide transmission medium, the S-Net to Ethernet converters (3595 9x) provide open access to all IMP data, right across your plant.

IP55 / NEMA 4 Equipment meeting these environmental specifications must be protected against damage and malfunction caused by the ingress of harmful dust, water from a jet-spray or the formation of ice on their casings. IMPs and VIMPs fully meet the specifications, to ensure that they will function perfectly in whatever conditions they are used.

Host Computer issues commands to IMPs and receives measurement data via one or more S-Nets. There are S-Net Interfaces for a wide variety of computers, handling all communication protocols and error checking.
Application software for the storage, manipulation and display of data is available from a number of our Value Added Resellers (VARs) and can be a standard product, or customized for your specific needs.

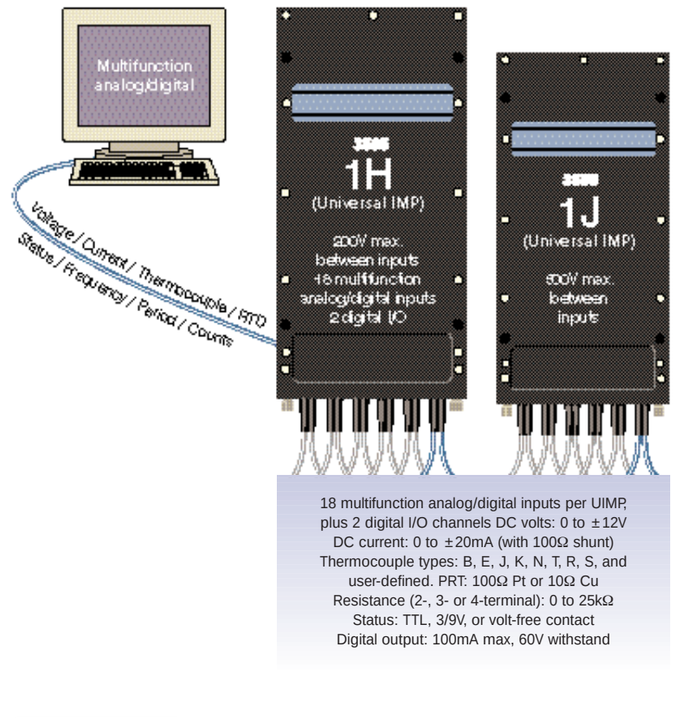
The IMP Family...

The IMP family includes eleven different IMPs to tackle virtually any plant monitoring requirement.

Each IMP consists of a measurement module and a connector block; this makes installation very simple, and even allows IMPs to be shared between different locations.

IMP Type	35951A	35951B	35951C	35951D	35951E	35951H	35951J	35952A	35952B
No. channels	20	10	20	4	20	20	20	20	32
Measurements	Analog	Analog	Analog	Analog	Analog	Multi	Multi	Digital	Digital
Voltage dc	▌	▌	▌		▌	▌	▌		
Resistance		▌				▌	▌		
Current dc	▌		▌		▌	▌	▌		
Thermocouples	▌		▌		▌	▌	▌		
PRT		▌				▌	▌		
Strain		▌							
Status						▌	▌	▌	▌
Frequency						▌	▌	▌	
Period						▌	▌	▌	
Events								▌	▌
Counts						▌	▌	▌	
Digital outputs						▌	▌	▌	▌
Current outputs				▌					
Voltage outputs				▌					

For vibration, the 1F and 1G VIMPs (Vibration IMPs) provide extensive facilities for measuring vibration levels and frequency spectra; these are fully described in the separate VIMP brochure.



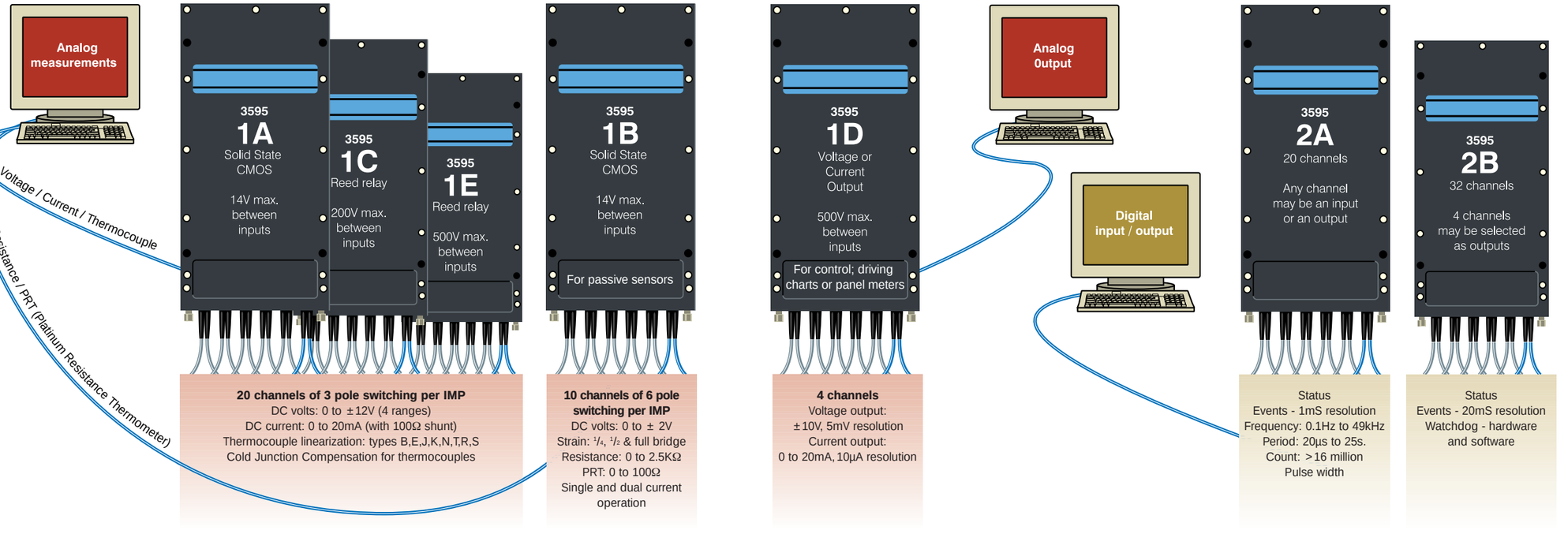
18 multifunction analog/digital inputs per UIMP, plus 2 digital I/O channels DC volts: 0 to ±12V
DC current: 0 to ±20mA (with 100Ω shunt)
Thermocouple types: B, E, J, K, N, T, R, S, and user-defined. PRT: 100Ω Pt or 10Ω Cu
Resistance (2-, 3- or 4-terminal): 0 to 25kΩ
Status: TTL, 3/9V, or volt-free contact
Digital output: 100mA max, 60V withstand

For mixed analog and digital I/O, the 1H and 1J Universal IMPs overcome the need for two or more separate IMPs, without compromising measurement specifications.

For analog measurements, the 1A, 1B, 1C and 1E IMPs provide facilities for

- Measurement of voltage, current, temperature (thermocouples and PRTs), resistance and strain on 10 or 20 channels
- 3- and 6-pole switching - to minimize the effects of common-mode interference and provide accurate measurement of resistance and strain
- Dual current supplies - for making resistance based measurements
- Cold junction compensation for thermocouple measurements
- Reed-relay switching for signals with high common mode voltages

Each channel operates independently, so that any IMP can be used to measure a variety of different parameters.



20 channels of 3 pole switching per IMP
DC volts: 0 to ±12V (4 ranges)
DC current: 0 to 20mA (with 100Ω shunt)
Thermocouple linearization: types B,E,J,K,N,T,R,S
Cold Junction Compensation for thermocouples

10 channels of 6 pole switching per IMP
DC volts: 0 to ± 2V
Strain: ¼, ½ & full bridge
Resistance: 0 to 2.5KΩ
PRT: 0 to 100Ω
Single and dual current operation

4 channels
Voltage output:
±10V, 5mV resolution
Current output:
0 to 20mA, 10µA resolution

Status
Events - 1mS resolution
Frequency: 0.1Hz to 49kHz
Period: 20µs to 25s.
Count: >16 million
Pulse width

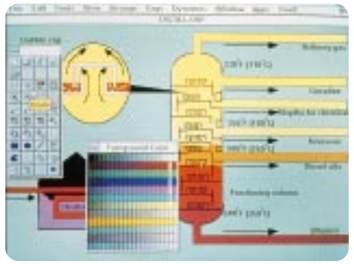
Status
Events - 20mS resolution
Watchdog - hardware and software

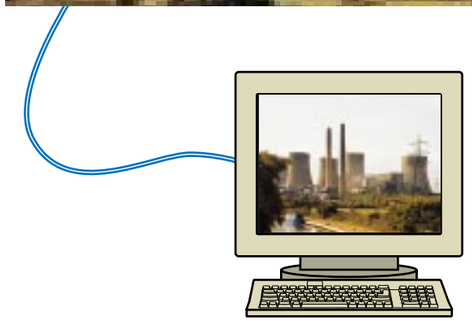
For analog output and control, the 1D IMP gives 4 channels of controlled voltage or current output.

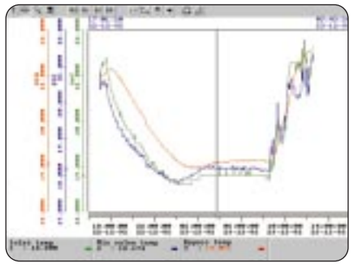
The 2A and 2B IMPs are used for **digital input / output and status** and can provide

- Up to 32 channels of digital input
- Up to 20 channels of digital output
- TTL or “12v” thresholds
- Built-in energization for voltage-free switch inputs
- Measurement of most types of digital sensors

Total systems or hardware only - it's your choice







The flexibility of the IMP family and the huge range of applications means that no one supplier can fully meet the needs of every user.
Solartron's policy is to work with Value Added Resellers (VARs) and Systems Integrators in order to ensure that you receive the best possible support for your complete system. Together with our network of business partners we can supply data acquisition systems across a whole spectrum of applications - from low cost 'off the shelf' packages to fully customized systems capable of measuring many thousands of channels for Process Monitoring, Condition Monitoring, etc.

Solartron IMPs are supported world-wide by a wide range of popular software packages for SCADA, Process Monitoring, Data Acquisition and Predictive Maintenance. They are available with local language support, in American, British, French, Swedish, German and Chinese versions, for DOS, Windows 3.1, 95, 98 and NT, and Unix.
In addition drivers are also available to support the many software packages developed in-house by power utilities - e.g. National Power (CUTLASS), Nuclear Electric (ECOS), and Electricité de France (Patern).
A separate brochure listing our business partners is available; contact your local Sales Office for a copy.

Technical description

Physical
Each IMP consists of a sealed case containing a measurement module and a separate connector block which slides into the main IMP housing and is screwed securely in place.
This enables an IMP to be removed easily for recalibration without the necessity to rewire any of the transducer and S-Net connections.
All connections are made by screw terminals.
There are different connector blocks for each IMP. Each connector block can be supplied with rubber teats or with cable glands for cable diameters 3.5 to 6.5mm.
IMP cases meet NEMA 4 / IP55 standards for enclosures: when installed correctly they will withstand dirty and dusty atmospheres and water from a jet-spray. Built from aluminium and finished with epoxy paint, they are also highly resistant to corrosion.
IMPs can also operate in temperatures as low as -20°C (-4°F), and as high as 70°C (158°F).
Whether it's hot, cold, dirty or wet - IMPs can take it!

Electrical
At the heart of every IMP is a microprocessor which responds to commands received from the host computer via S-Net. The processor controls the measurement setup and data acquisition and communicates data and other responses to the host. Measurements are stored within the IMP until required by the host.
IMPs have a low power requirement and can be powered directly from the host computer via S-Net. However, depending on the number of IMPs on an S-Net, and the length of the S-Net cable, it may be desirable to power IMPs from a local dc power supply. (VIMPs must always be powered locally.) More details on suitable S-Net cables and power supplies are given on page 15.

3595 Series IMP Specifications

General

IMP Environment

Storage temperature:	-25° to 75°C (-13° to 167°F)
Operating temperature:	-20° to 70°C (-4° to 158°F)
Humidity, at 40°C (non-condensing):	95%
Vibration, operating for 2 hours:	5g, 11Hz to 500Hz

Otherwise, to Def. Std 66/31, Issue 01, Cat. IV.

IMP Packaging

Sealed aluminium casing to BS5490, IP55 (IEC 529) and NEMA ICS6 Class 4.

IMP dimensions:	435mm x 215mm x 34.5mm (17.1" x 8.5" x 1.4")
Universal IMP dimensions:	470mm x 250mm x 48mm (18.5" x 9.8" x 1.9")
Protrusion of cable boots:	50mm (2")
Weight:	2.5kg (5.5lbs)

IMC Environment

Storage temperature:	-25° to 75°C (-13° to 167°F)
Operating temperature:	-10° to 60°C (14° to 140°F)
Humidity, at 40°C (non-condensing):	85%
Vibration, operating for 2 hours:	1g,11Hz to 500Hz

Otherwise, to Def. Std 66/31 Issue 01 Cat. IV.

IMC Packaging

Dimensions:	420mm x 218mm x 30mm (16.54" x 8.58" x 1.18")
Protrusion of handles:	30mm (1.18")
Weight:	1.23kg (2.69lbs)

General - IMP and IMC Specifications

Power supply:	10V to 50V dc
Power feed:	via S-Net cable or IMP terminals
Power consumption of each IMP:	<1.2W* (U-IMP: <1.7W)
Results returned from all IMPs on S-Net:	<1s
Isolation, IMP to IMP or to S-Net:	500V
Analog to digital converter:	15 bits + sign

Analog scanner leakage currents at 25°±3°C (77°±5°F):

3595 1A/1B:	<60nA
3595 1C, 1H, 1J:	<15nA
ADC input impedance (all analog IMPs and 1H, 1J):	>10GΩ
Analog IMP, Channel Crosstalk:	>120dB
Analog IMC, Channel Crosstalk @ RH <50%:	>120dB
Analog IMC, Channel Crosstalk @ RH <75%:	>100dB

*The 3595 1D can consume more in certain circumstances
All limits of error shown in the following specifications are for 1 year at 20°±3°C (68°±5°F)

Safety

Low voltage directive: EN61010

EMC/RFI

Emission EN50081-2 (Industrial)
Immunity EN50082-2 (Industrial)

Analog Measurements

There are 4 analog measurement IMPs, each with a precision integrating pulse width, auto-ranging 16 bit ADC for measuring signals from a few microvolts. For easy selection of the right model for your application refer to page 4.
Integration times are selectable for excellent noise rejection in 50Hz or 60Hz environments or for faster acquisition rates. To maintain the highest accuracy and linearity, drift correction to all ranges is applied automatically between scans.

Results, converted to engineering units when required, are buffered ready for transmission back to the host computer. Buffering allows continuous operation to achieve maximum data throughput.
Calibration is made easy with the 3595 3Z calibration connector kit.
New calibration values are stored in the IMP's non-volatile memory.
All IMP channels are independent so that transducer and measurement types can be different for every channel, if required.

3595 1A / 1C / 1E Analog Measurement IMP
3595 51A / 51C / 51E Analog Measurement IMC

3595 1A and 3595 51A

Number of channels:	20
Switching:	solid-state, 3-pole
Maximum signal measured:	±12V
Overload protection, continuous:	50V
Maximum voltage between any input and any guard:	14V
Common mode, between IMPs:	500V
Mean Time Between Failures, to MIL 217E:	137,000 hrs (IMP) 146,000 hrs (IMC)

Measurement

Voltage dc:	0 to ±12V
Current dc (assuming 100Ω shunt):	0 to 20mA
Thermocouple types:	B,E,J,K,N,T,R,S
Thermocouple Cold Junction:	External or Automatic
Thermocouple open circuit detection:	programmable

3595 1C, 3595 1E, 3595 51C and 3595 51E

Number of channels:	20
Switching:	reed-relay, 3-pole
Reed relay life:	$>10^8$ operations
Maximum signal measured:	±12V
Maximum input voltage:	±14V
Overload protection, continuous:	50V
Maximum voltage between any two inputs: 3595 1E:	500V
3595 1C:	200V
Common mode, between IMPs:	500V
Mean Time Between Failures, to MIL 217E:	64,000 hrs (IMP) 69,000 hrs (IMC)

Measurement

Voltage dc: without optional connector:	0 to ±12V
Current dc (assuming 100Ω shunt):	0 to 20mA
Thermocouple types:	B,E,J,K,N,T,R,S
Thermocouple Cold Junction:	External or Automatic
Thermocouple open circuit detection:	programmable

3595 3D Optional High Voltage Connector

Voltage dc:	0 to ±250V
Overload protection, continuous:	250V
Effective common mode rejection; dc:	>100dB
50 or 60Hz ±0.1%:	>100dB
Attenuation factor:	50:1

Interference Rejection -1A, 1C and 1E IMP or IMC
(Specifications are for 1kΩ imbalance in Hi and Lo Leads)

20ms/16.67ms Integration time

Normal mode, 50 or 60Hz ±0.1%	>60dB
Effective common mode rejection; dc:	>140dB
50 or 60Hz ±0.1%:	>140dB
50 or 60Hz ±1%:	>120dB

5ms/4.17ms/1.25ms/1.04ms Integration time:

Normal mode, 50 or 60Hz ±0.1%	>0dB
Effective common mode rejection, 50 or 60Hz ±0.1%	>80dB

DC Voltage
Temperature coefficient of ADC: <(0.0015%rdg+0.2μV) per °C
3595 3D High Voltage Connector introduces 100μV +0.04% rdg additional error.

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20ms/16.67ms Integration time:

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	1μV	±[0.02%rdg + 5μV]
200mV	220.00	10μV	±[0.02%rdg + 0.01%fs]
2V	2.2000	100μV	±[0.01%rdg + 0.01%fs]
12V	12.000	1mV	±[0.05%rdg + 0.01%fs]

5ms/4.17ms Integration time:

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	2μV	±[0.02%rdg + 20μV]
200mV	220.00	20μV	±[0.02%rdg + 0.04%fs]
2V	2.2000	200μV	±[0.01%rdg + 0.04%fs]
12V	12.000	2.5mV	±[0.05%rdg + 0.04%fs]

1.25ms/1.04ms Integration time:

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	8μV	±[0.02%rdg + 80μV]
200mV	220.00	80μV	±[0.02%rdg + 0.16%fs]
2V	2.2000	800μV	±[0.01%rdg + 0.16%fs]
12V	12.000	8mV	±[0.05%rdg + 0.16%fs]

DC Current

Sensitivity, (assuming 100Ω shunt):	10nA

Error as for DC Voltage + error of shunt resistor + leakage currents

Thermocouples
The following figures are based on 20ms/16.67ms integration times.
All specified in degrees Celsius.
Error quoted is conformity to IEC584 (BS4937).
(IMC 3595 51A, 51C and 51E must be in draught-free enclosure: no forced cooling)

Type	Mid Range	Error	Full Range	Error
B (Pt-30% Rh/Pt-6%Rh)	400 to 1820	<0.3	80 to 1820	<2.0
E (Ni-Cr/Cu-Ni)	-100 to 250	<0.3	-210 to 1000	<0.5
J (Fe/Cu-Ni)	-100 to 350	<0.3	-210 to 1200	<0.7
K (Ni-Cr/Ni-Al)	-100 to 450	<0.3	-200 to 1370	<1.0
N (Nicrosil/Nisil)	-180 to 1280	<0.3	-250 to 1300	<0.8
T (Cu/Cu-Ni)	-100 to 400	<0.3	-200 to 400	<0.5
R (Pt-13% Rh/Pt)	0 to 1600	<1.0	-50 to 1760	<2.0
S (Pt-10% Rh/Pt)	0 to 1760	<1.0	-50 to 1760	<1.5

Sensitivity, Types B,E,J,K,N,T:	0.1°C (0.18°F)
Sensitivity, Types R,S:	0.2°C (0.36°F)

Total thermocouple error equals Conformity plus voltage errors
Additional error when using automatic Cold Junction Compensation:

Range	-15° to 60°C (5° to 140°F):	<0.4°C (0.72°F)
	-20° to 70°C (-4° to 158°F):	<0.6°C (1.08°F)
External Cold Junction range:		-30°C to +80°C (-22° to 176°F)
Open circuit detection threshold:		1.9kΩ ± 0.1kΩ

All Analog IMPs are calibrated to the internationally unified volt.
Traceability is to the appropriate national standard.

The 3595 1A contains a solid state CMOS FET switch for low voltage applications. The 3595 1C and 1E contain reed-relays that are ideal for applications requiring high inter-channel isolation; for example, working in parallel with an existing plant indicator or control system. The 1E with its 500 volt isolation is fast becoming our most popular model. Both the 1C and 1E can measure up to 250 volts with the optional high voltage connector (3595 3D).

The 3595 1B contains 10 channels of 6 pole solid state CMOS FET switches and is specifically designed for use with PRTs, strain gauges and other resistance-based transducers. For accurate 4-wire resistance measurement single current energization is used. For strain gauge applications dual current energization is used in order to eliminate balance and sensitivity controls - and the special signal conditioning - that is normally required.

The 3595 1D is an analog output (voltage or current) IMP that is suitable for applications requiring supervisory or direct control, or with remote panel meters and strip chart recorders.
Voltage can be controlled over the range ±10V and current in the range 0-20mA or 4-20mA.
Initial values on power-up are selectable.

3595 1B Analog Measurement IMP
3595 51B Analog Measurement IMC

Number of channels:	10
Switching:	solid-state, 6-pole
Maximum signal measured:	±2V
Overload protection, continuous:	50V
Maximum voltage between any input and any guard:	14V
Common mode between IMPs:	500V
Mean Time Between Failures, to MIL 217E:	106,000 hrs (IMP) 113,000 hrs (IMC)

Measurement

Voltage dc:	0 to ±2V
Resistance, 4 & 3 Terminal:	0 to 2.5kΩ
Resistance Thermometer, 4 & 3 Terminal:	100Ω PRT
Strain:	3-wire, ¼-, ½- and full-bridge
Sensor energization:	0.8 or 4mA
Dummy supplied:	120Ω±0.1%±5ppm/°C

Interference Rejection
(Specifications are for 1kΩ imbalance in Hi and Lo Leads)

20ms/16.67ms Integration time:

Normal mode, 50 or 60Hz ±0.1%	>60dB
Effective common mode rejection; dc:	>120dB
50 or 60Hz ±0.1%:	>120dB
50 or 60Hz ±1%:	>100dB

5ms/4.17ms/1.25ms/1.04ms Integration time:

Normal mode, 50 or 60Hz ±0.1%	>0dB
Effective common mode rejection, 50 or 60Hz ±0.1%	>80dB

DC Voltage
Temperature coefficient of ADC: <(0.0015%rdg+0.2μV) per °C

20ms/16.67ms Integration time:

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	1μV	±[0.02%rdg + 5μV]
200mV	220.00	10μV	±[0.02%rdg + 0.01%fs]
2V	2.2000	100μV	±[0.01%rdg + 0.01%fs]

5ms/4.17ms Integration time:

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	2μV	±[0.02%rdg + 20μV]
200mV	220.00	20μV	±[0.02%rdg + 0.04%fs]
2V	2.2000	200μV	±[0.01%rdg + 0.04%fs]

1.25ms/1.04ms Integration time.

Range	Full Scale	Sensitivity	Limits of Error
20mV	22.000	8μV	±[0.02%rdg + 80μV]
200mV	220.00	80μV	±[0.02%rdg + 0.16%fs]
2V	2.2000	800μV	±[0.01%rdg + 0.16%fs]

Resistance
Temperature coefficient: <(0.003%rdg+0.0007%RL) per °C
The single lead resistance, RL, only applies to 3-wire configurations.
Any lead resistance imbalance should be added to the error in 3-wire configurations.

20ms/16 67ms Integration time:

Range	Sensitivity	Limits of Error
25Ω	1.25mΩ	±[0.03%(rdg + RL) + 6mΩ]
250Ω	12.5mΩ	±[0.03%(rdg + RL) + 0.01%fs]
2.5kΩ	0.125Ω	±[0.02%rdg + 0.03%RL + 0.01%fs]

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5ms/4.17ms Integration time:

Range	Sensitivity	Limits of Error
25Ω	2.5mΩ	±[0.03%(rdg + RL) + 24mΩ]
250Ω	25mΩ	±[0.03%(rdg + RL) + 0.04%fs]
2.5kΩ	250mΩ	±[0.02%rdg + 0.03%RL + 0.04%fs]

1.25ms/1.04ms Integration time:

Range	Sensitivity	Limits of Error
25Ω	10mΩ	±[0.03%(rdg + RL) + 96mΩ]
250Ω	100mΩ	±[0.03%(rdg + RL) + 0.16%fs]
2.5kΩ	1.0Ω	±[0.02%rdg + 0.03%RL + 0.16%fs]

Resistance Thermometer Device
Conformity for 100Ω PRT (RTD) is to IEC 751
Temperature coefficient <(0.03+0.002%RL)°C per °C
The error introduced by the single lead resistance, RL, is an additional error which applies only to 3-wire configurations
Any lead resistance imbalance should be added to the error in 3-wire configurations.

20ms/16.67ms Integration time:

Range	Sensitivity	Limits of Error
-200 to 490°C	0.1°C	±[0.4 + 0.1%RL]°C
490 to 600°C	0.1°C	±[1.2 + 0.1%RL]°C

Strain
Repeatability at constant temperatures over 24 hours is ±2με for all configurations shown below.
Figures are for 120Ω gauges with gauge factor 2.
Measurement range for figures quoted: 0 to 10,000με

20ms/16 67ms Integration time:

Type	Limits of Error	Temperature Coefficient
Full bridge (8mA, 2 active gauges)	±[0.06%rdg + 6με]	<(0.33με + 0.004%rdg) per °C
½-bridge (4mA, 1 active gauge)	±[0.06%rdg + 8με]	<(3.45με + 0.004%rdg) per °C
¼-bridge (4mA, 1 active gauge)	±[0.06%rdg + 14με]	<(8.45με + 0.004%rdg) per °C

3595 1D Analog Output IMP
3595 51D Analog Output IMC

Number of channels:	4
Output functions:	Bipolar dc voltage, unipolar dc current
Isolation between channels:	500V dc
Output noise:	<0.1% fs
Settling time to 1 bit:	75ms from transmission from host 40ms between channel values
Mean Time Between Failures to MIL 217E:	94,000 hrs (IMP) 103,000 hrs (IMC)

Voltage Outputs

Range:	-10V to +10V
Resolution:	12 bits, 5.12mV
Minimum load resistance:	10kΩ
Limits of error:	±[0.1%rdg + 10mV]
Temperature coefficient:	±[0.01%rdg + 1mV]/°C

Current Outputs

Range:	0mA lo 20mA
Resolution:	11 bits, 10.25μA
Output voltage compliance:	16V±1V at min. current, 10V at max. current
Current output limit:	25mA
Limits of Error:	±[0.1%rdg + 20μA]
Temperature coefficient:	[0.01%rdg + 2μA]/°C

Power Consumption Voltage o/p: 1.2W Current o/p: 3.3W

Digital Measurements

There are two digital IMPs, the 3595 2A and 2B. For easy selection of the right model for your application refer to the IMP Selection Guide on page 4.

The 2A has 20 channels, any of which may be configured as inputs with TTL or “12V” thresholds, or FET switched outputs. It can be used to measure status, frequency, period, and incremental or totalizing counts. It is ideal for almost all types of transducers with pulse outputs, such as flowmeters or speed sensors. Events can be timed to within 1ms anywhere across the whole IMP network, enabling an accurate picture of sequential events to be logged. A built-in supply can be used for “volt free” inputs, and to provide TTL output levels.

The 2B provides 32 transformer-isolated input channels, four of which can be configured as FET switched outputs. Each input, which can be measured as voltage or resistance, is sampled every 20ms to determine its status; transitions (positive, negative or both) are logged and transmitted to the host. The IMP also includes a hardware and software watchdog on channel 32 which can be used to detect a failure within the IMP, or with the host / S-Net if a status message is not received within a programmable timeout period.

3595 2A Digital Input/Output IMP
3595 52A Digital Input/Output IMC

Number of channels (may be an input or output):	20
Isolation, channel to channel or ground:	500V
Common mode between IMPs:	500V
Mean Time Between Failures, to MIL 217E:	145,000 hrs (IMP) 155,000 hrs (IMC)

Inputs

Voltage thresholds (0 and 1):	0.8 and 2.0V, or 3.0 and 9V
Maximum input:	25V or 100V
Min. input drive current:	600µA
Input sample rates, programmable:	20Hz; 1kHz; 10kHz; 100kHz
4 sample debounce is used for 20Hz and 1kHz rates	
Input functions	
Status:	
Events, (time of +ve or -ve edge), accuracy:	±1ms
Frequency:	49kHz max
Frequency gate times, programmable:	0.01; 0.1; 1 or 10s
Period, resolution:	10µs
Periods averaged:	1; 10; 100; 1000; +ve or -ve pulse
Single shot minimum width:	10µs
Count (totalize or increment):	24 bits (>16 million)

Outputs

FET switch which closes for a logic 1.	
Maximum withstand:	60V
Maximum sink per channel:	100mA
Energization supply, built in:	5V, 20mA

Digital Input Counting and Event Capture (per channel)

Maximum count rate per IMP is 15,000/s and is governed by software constraints. Thus for a worst-case input (all channels driven by the same signal) maximum count per channel is restricted to 750/s.
Maximum number of buffered events is 1,500 per IMP.

Sample Rates	20Hz	1kHz*	10kHz	100kHz
Count Parameters:				
Maximum frequency	2.4Hz	124Hz	4.9kHz	49kHz
Minimum period	400ms	8ms	200µs	20µs
Resolution of period	50ms	1ms	100µs	10µs
Counts max. rate	2.4/s	124/s	4900/s	15,000/s
Event capture rate	5/s	100/s	100/s	100/s
Event resolution	200ms	4ms	1ms	1ms

Figures assume an equal mark / space ratio. *indicates default setting

continued in next column

Frequency

Figures are for the default sample rate of 100kHz

Gate Time:	10ms	100ms	1s	10s
Min frequency	100Hz	10Hz	1Hz	0.1Hz
Resolution	100Hz	10Hz	1Hz	0.1Hz
Limits of Error		±[0.004%rdg + resolution]		

Frequency signals with a value less than 0.1Hz should be measured using event capture mode. All Limits of Error assume an equal mark / space ratio.

Period

Figures are for the default sample rate of 100kHz

Periods Averaged:	1	10	100	1000
Resolution	10µs	1µs	0.1µs	0.01µs
Limits of Error		±[0.004%rdg + resolution]		

Period measurements have a programmable timeout applied. The timeout must be at least double the expected period. Timeouts of 200ms, 2s, 20s and 50s are available. The maximum period is therefore 25s. Period measurements greater than 25s should use the Event Capture mode.
All Limits of Error assume an equal mark / space ratio.

3595 2B Switch Input/Output IMP
3595 52B Switch Input/Output IMC

Number of channels (may be 1-32 inputs, 1-4 outputs):	32 total
Isolation, channel to channel or ground:	120V
Common mode, between IMPs / IMCs:	500V
Mean Time Between Failures, to MIL 217E:	124,000 hrs(IMP) 130,000 hrs (IMC)

Inputs

Voltage thresholds (0 and 1):	3.0 and 9.0V
Resistance thresholds (0 and 1):	80kΩ and 500kΩ
Maximum input:	120V
Minimum input drive current:	600µA
Input sample rate:	50Hz
(4 sample debounce is used)	
Input functions:	Status
	Events
Accuracy of event timing (+ive or -ve edge)	±20ms
Maximum number of buffered events per IMP/IMC	128

Outputs

FET switch, which closes for a logic 1.	
Maximum withstand:	60V
Maximum sink, per channel:	100mA

Watchdog

Hardware Timeout	1.2s
Software Timeout, programmable:	1 to 255s

3595 1H/1J Universal IMPs

Analog measurements and digital I/O in a single package.

The Universal IMP (Isolated Measurement Pod) offers tremendous potential for system designers to create flexible and cost effective solutions in a wide variety of SCADA, C & I and DAS environments. With 18 multifunction analog/digital inputs, and two dedicated digital I/O channels, it is ideal in applications such as front-end alarm monitoring and control, where it overcomes the need for two separate IMPs, reduces cabling costs, increases channel utilization, and opens up possibilities which were previously impractical. In addition to all the normal advantages of the IMP family, the Universal IMP has additional features designed to enhance system reliability and performance:

- **Large data memory** ensures that no data is lost during temporary failure of host computer
- **Autonomous alarm checks** Even if the host PC or DCS fails, digital outputs can still be triggered by alarm levels on analog inputs - ideal for low cost machinery protection systems

U-IMP Specification

General

Number of channels		
Analog/ Status		18
Smart digital I/O		2
Isolation: IMP to IMP, IMP to S-Net, IMP to ground		500V
Power Supply		10V to 50V dc
Power feed		via S-Net cable or IMP terminals
Power consumption per IMP		<1.7W
Results returned from all IMPs on S-Net		<1s
Result storage		>19,200

Analog/Status (Channels 1-18)

Analog channel switching		configurable 3- or 6-pole relays (6 pole uses two channels)
Reed relay life		$>10^8$ operations
Maximum signal measured		±12V
Overload protection, continuous		50V
Maximum voltage between inputs	3595 1H	200V
	3595 1J	500V
Channel crosstalk		<120dB
Voltage dc		0 to ±12V
Current dc (assuming 100Ω shunt)		0 to 20mA
Resistance (2-, 3*-, 4*- terminal)		0 to 25kΩ
Status		TTL, 3/9V, or volt free contact (volt-free uses 2-terminal resistance measurement)
Thermocouple types		B,E,J,K,N,T,R,S, & user defined (user 5th order polynomial, 2 types)
Thermocouple cold junction		External or Automatic
Thermocouple open circuit detect		programmable on/off (threshold 1.9kΩ ± 0.1kΩ)
Thermocouple condition monitoring		loop resistance report (loop resistance ± 0.1kΩ)
Resistance thermometer (RTD)		100Ω PRT (3 & 4 terminal*) 10Ω Copper (4 terminal*)

** 3- and 4-terminal measurements use 6-pole relays (two channels)*

For range, sensitivity and Limits of Error data on DC Voltage, DC Current, and Thermocouples, refer to 3595 1C specification for 1H, and 3595 1E specification for 1J.

For range, sensitivity and Limits of Error data on 3- and 4-terminal Resistance and Resistance Thermometer Device measurements, refer to the 3595 1B specification.

Resistance, 2-wire

Temperature coefficient: < [0.003%rdg + 0.5Ω] per °C

20ms/16 67ms Integration time:

Range	Sensitivity	Limits of Error
500Ω	0.125Ω	±[0.02%rdg + 50Ω +0.05%fs]
25kΩ	1.25Ω	±[0.02%rdg + 50Ω +0.01%fs]

5ms/4.17ms Integration time:

Range	Sensitivity	Limits of Error
500Ω	0.25Ω	±[0.2%rdg + 50Ω +0.02%fs]
25kΩ	2.5Ω	±[0.02%rdg + 50Ω +0.04%fs]

1.25ms/1.04ms Integration time:

Range	Sensitivity	Limits of Error
500Ω	1Ω	±[0.02%rdg + 50Ω +0.8%fs]
25kΩ	10Ω	±[0.02%rdg + 50Ω +0.16%fs]

Resistance Thermometer Device (10Ω copper), 4-wire only

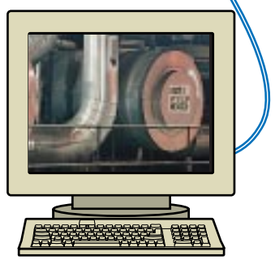
Temperature coefficient (over -100 to 150°C): < 0.02°C per °C

20ms/16.67ms Integration time:

Range	Sensitivity	Limits of Error
-100 to 150°C	0.1°C	±0.3°C

Digital Channels 19,20

For specification, refer to the 3595 2A specification, but note that U-IMP does not support event counting, and does not have a built-in energization supply.



3595 Series IMP Interfaces

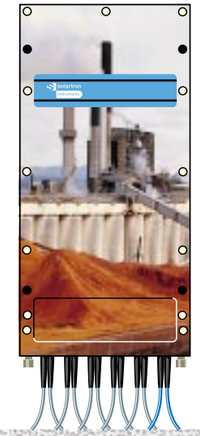
The unique IMP / S-Net concept provides all the advantages of a dedicated network system - low cost of installation, high data integrity, integral power, data and communications - with the ability to connect directly into a wide range of standard hardware and network platforms. Your investment is protected in the future because systems can easily be expanded by adding new S-Nets to an existing interface, or, for more ambitious projects, by adding further interfaces or upgrading the host computer.

Interface modules are available for Ethernet (TCP/IP), IBM-PC, IEEE-488 (GPIB), RS423 and DEC Q-bus, and each is supplied with appropriate software device drivers. Each interface can power a small IMP system directly, or up to 50 IMPs when used with an external power supply. A table showing the main features of each interface is shown below, and further details are given in the following pages.

Part number	Interfaces to	Physical	Maximum number of IMPs per network	Maximum number of S-Nets per interface	Maximum number of channels
3595 **4B**	IBM-PC	Half-length standard I/O card	50	1	1,000 analog 1,600 digital
3595 **9A**	Ethernet	19 inch rack	50	4	4,000 analog 6,400 digital
3595 **9B**	Ethernet	Pod	50	1	1,000 analog 1,600 digital
3595 **9D**	Ethernet	Module	50	2	2,000 analog 3,200 digital
3595 **6A***	DEC Q-bus	Quad height card	50	1	1,000 analog 1,600 digital
3595 **8A***	GPIB or RS423	Half-rack box	50	1	1,000 analog 1,600 digital

*For more details of 6A and 8A interfaces, please contact your local sales office.

Interfacing to the IBM-PC family



The most popular of our interfaces, the 3595 4B enables you to bring your IMP data into any IBM-PC or compatible machine, opening up a myriad of opportunities for further processing, data presentation and storage.
The card occupies one slot in the PC, and contains its own coprocessor and 8kbyte dual-port memory to handle network management, error checking and data buffering. Data is exchanged with the PC via a selectable 512-byte memory-mapped window or using the port addressing mode. Several 4B cards, each driving a separate S-Net, may be present in one PC if required. The interface can power up to 5 IMPs via the PC's own supply; for larger systems an external power supply must be connected via the on-board connector.

Specification

S-Net Capability
- Max. length of cable: 1,500m. (1 mile)
- Max. no. of IMPs:
  - with external psu: 50
  - powered from PC: 5

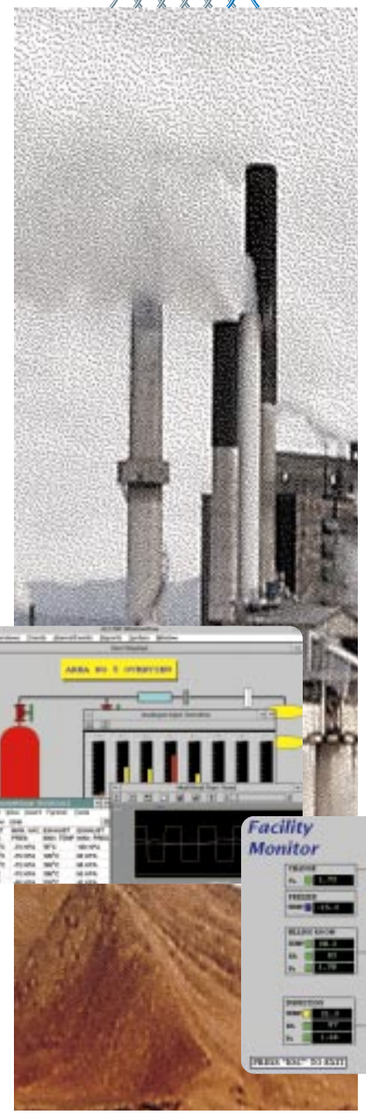
PC operating requirements
- Address space: 512 bytes, base address selectable
- Address selection: 80000H to FFE00H in steps of 512 bytes
- IRQ (Interrupts): selectable from IRQ2,3,5-7,10-14 or disabled
- Power
  - 5v supply: 600mW max.
  - 12v supply: 50mW max. plus 1.2W max. for each IMP powered from supply

External Power Supply (if used)
- Voltage: 12 to 50Vdc, (depending on length and gauge of S-Net cable and number of IMPs)
- Output Ripple: <100mV rms
- Current: 1.2W per IMP

Environment
- Temperature
  - Operating: 0° to 55°C (32° to 131°F) @ 50%RH; 0° to 45°C (32° to 113°F) @ 95%RH
  - Storage: -40° to 70°C (-40° to 158°F)
- Humidity
  - Operating: 8 to 95% rh
  - Storage: 0 to 95% rh

Physical (Half-length PC I/O card)
- Length: 179mm / 7.05in.
- Height: 130mm / 5.12in.
- Width: 25mm / 1.0in.
- Weight: 0.2kg / 0.44lbs

Accessories supplied
- 10m. S-Net cable, connectors, terminators, operating manual, starter disk.



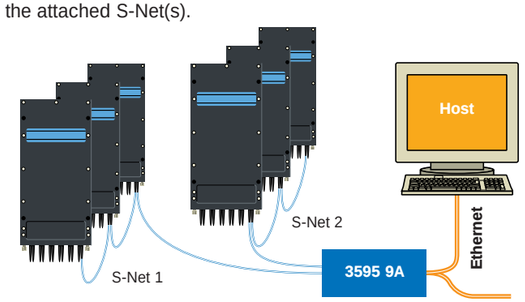
3595 9A/9B/9D Open access via Ethernet

The IMP S-Net to Ethernet interface offers virtually limitless possibilities for transferring your plant data to wherever it is needed - even to the other side of the world, if necessary! Ethernet has become the recognised standard for high speed data transmission within large plants... and beyond. These interfaces provide an effective gateway into plant-wide data networks for data archiving and consolidation.

There are three versions of the S-Net to Ethernet Interface:

- 3595 9A - connection for up to 4 S-Nets, in 19in. rack;
- 3595 9B - limited to one S-Net, IP55 protected case;
- 3595 9D - connection to one or two S-Nets, in smaller case for cabinet or wall mounting.

The interface operating system and server software is downloaded via Ethernet from the host computer on power-up, using the BOOTP protocol. Several interfaces can be booted from a single host. It is then under the control of the host computer, which also issues commands to the IMPs on the attached S-Net(s).

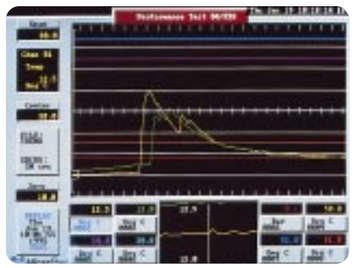


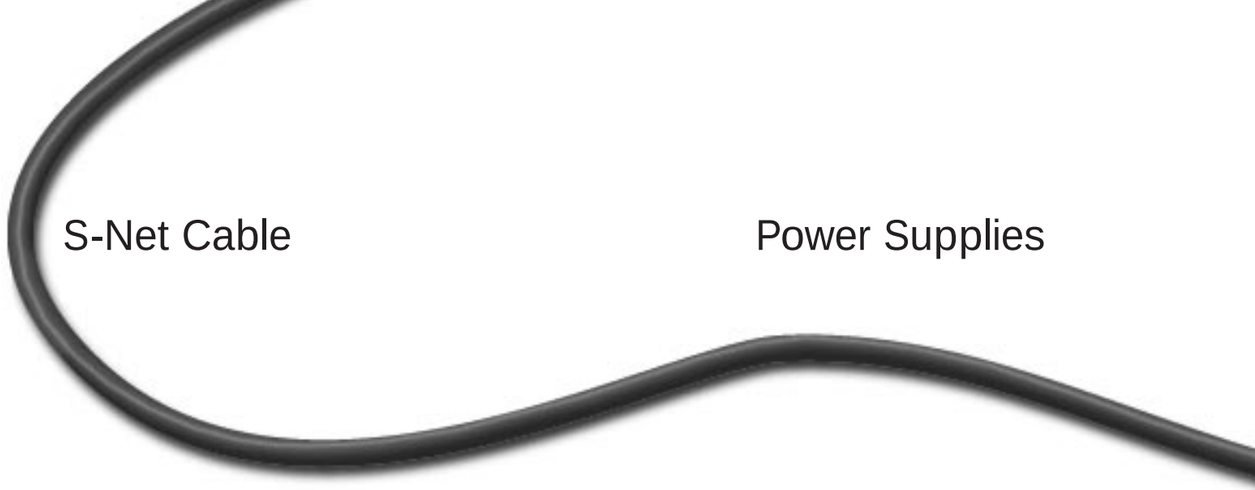
Specification

S-Net Capability			
	Max. length of cable	1,500m. (1 mile)	
	Throughput	850 channels/sec	
	Max. no. of IMPs:		
	with external psu	50	
	powered from PC	5 on each S-Net	
Ethernet Connections			
	Electrical Standard	Ethernet 10Mbps IEEE-802.3 Thin-wire 10Base-2	
	Transport protocol	TCP/IP	
	Connector Port Number	1234	
	Maximum connections	10	
AC Power			
	AC supply voltage, current	90 to 120 volts, <1A or 190 to 260 volts, <0.5A	
External Power Supply (if used)			
	Voltage	12 to 50Vdc, (depending on length and gauge of S-Net cable and number of IMPs)	
	Output Ripple	<100mV rms	
	Current	1.2W per IMP (1.7W for U-IMP)	
Environment			
	Temperature		
	Operating	0° to 45°C (32° to 113°F)	
	Storage	-40° to 50°C (-40° to 122°F)	
	Humidity		
	Operating	95% rh at 40°C (104°F) (non-condensing)	
	Storage	0 to 80% rh	
	Vibration	10mm. (0.4in.), 5 to 16Hz 1g, 16 to 30Hz	
	Safety	IEC1010	
Physical			
		3595 9A	**3595 9B**	**3595 9D**
	Width	485mm (19.09in.) (435mm (17.13in.) behind front panel)	400mm (15.75in.)	275mm (10.82in.)
	Height	180mm (7.09in.)	600mm (23.62in.)	180mm (7.09in.)
	Depth	468mm (18.43in.)	200mm (7.87in.)	400mm (15.75in.)
	Weight	12kg (26.5lbs)	20kg (44lbs)	8.0kg (17.6lbs)

Accessories supplied

The software is supplied on a single 1.44Mbyte 3.5in. floppy disk that contains the BOOTP operating system and server (compressed using the standard UNIX compress utility) and sample C source code for communicating with 3595 9A/B.





S-Net Cable

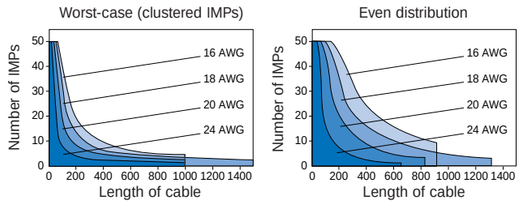
S-Net cabling is available from leading cable manufacturers or from Solartron in a range of gauges. The choice of gauge depends on the type of power supply, the number of IMPs to be used, their distribution along S-Net and the distance to be covered.

The following cable gauge selection graphs will help you specify suitable cabling for your system.

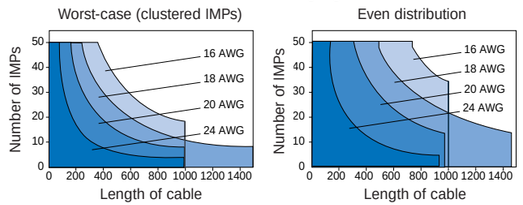
It is better practice to specify a higher voltage dc power supply, thus allowing higher gauge (thinner) cables to be selected.

The Universal IMPs may require slightly thicker cable than standard IMPs; consult Solartron for details.

Recommended wire gauge for 24V



Recommended wire gauge for 50V



Cable suppliers reference

Cable gauge	Anixter	Brand Rex	Alpha Cable	Belden	Solartron Instruments
16	501311	T12460	9820	9860	480120910
18	501569*	CD8920251*	-	9250	480121040*
20	501310	BC57207	9818	9207 9815 (direct burial)	480120920
24	501312	BI56641	2400	8641	480120700

*These cables are fire retardant to NEC CL2 and can be used, with a 48V dc power supply, for networks up to 1.5km

Power Supplies

Three power supplies are available for S-Net / IMP systems.
AC input (all types): 92-132/176-264Vrms
Operating temperature range (all types): 0° to 55°C (32° to 131°F)
(Note: power derates at 2.5%/°C above 35°C (95°F) on all types)

3595 95A - S-Net power supply
Output: 140 Watts, 48Vdc
Weight: 1.2Kg (2.6lbs)
Housed in a ventilated metal cover suitable for mounting in a panel or metal enclosure
Dimensions: 210 x 112 x 62mm (8.3 x 4.4 x 2.4in.)

3595 95B,D - Field power supplies
Output:
3595 95B 50 Watt, 48Vdc
3595 95D ±5Vdc, ±12Vdc
(powers 2 VIMPs of any type)
Weight: 10Kg (22lbs)
Housed in metal enclosures to IP55 and NEMA 4 standards
Dimensions: 300 x 300 x 200mm (11.8 x 11.8 x 7.9in.)

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Solartron is dedicated to the production of advanced measurement systems, with a world renowned reputation for excellence in design, manufacture and performance.

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To help you still further, additional technical reading material and application notes are also available on request.

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3593 Modbus Acquisition Modules - compact modules for rapid integration into factory or plant systems.

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