

# AMELEC

SIGNAL CONDITIONING

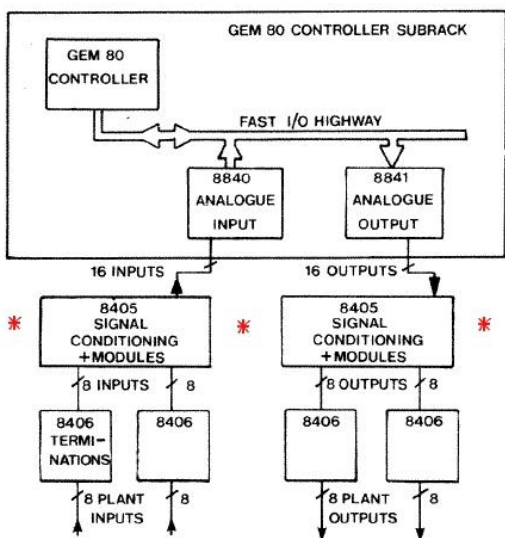
*Manufacture & Supply of Process Monitoring &*

*Control Instrumentation*



&

*Producers of the original GEC Industrial Controls  
GEM 80/8405-6 Series Signal Conditioning Modules\**



*Product Data Sheet  
8405-6 Series  
For GEC*

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## About Us

Originally formed in February 1975, AMELEC remains a wholly owned British manufacturing company celebrating our 35th year anniversary. In 2010 & 2011 we were awarded **100% score** in **quality** accreditation by the Achilles-UVDB verify scheme.

The instrumentation that AMELEC offers to the market place is based on analogue techniques, using readily available discrete components. The instruments contain no time dependent or microprocessor circuitry, are suitable for use in SIL 1, 2 or 3 rated safety systems/loops & all covered by up to 10 Year warranty.

Our design & everyday application engineering principles used in the instruments are based on well tried, proven in use for over thirty years, linear operational amplifier circuitry. Each instrument can be considered as a number of functional blocks assembled together to produce a specific control function.

A Signal Conditioner / Transmitter would comprise of an input circuit; a modulator / demodulator stage; an output circuit and the power supply/regulation circuitry. A trip amplifier might use the same input circuit, this time a comparator and relay driver stage plus the power supply / regulation circuitry.

By combining these functional blocks together we have produced a comprehensive range of Trip Amplifiers, Transmitters, Signal Converters / Isolators, combined Trip Transmitters, Arithmetic (Add / Subtract / Select / Multiply / Divide) units, Power Supplies, Strain Gauge, Frequency & AC I/V Transducers, as well as Hart compatible units. The circuit building blocks we use today are essentially the same as the ones we have used for the last thirty years.

To confirm that the instruments are compliant with the latest standards, AMELEC have submitted a range of instruments with all the various circuit blocks in them to the test houses. The reference / standards used at the test houses have been:- the CEGB's EES1989, the BS6667, IEC801 and more recently the IEC61000. All instrumentation produced by AMELEC is controlled under our Lloyds approved **ISO 9001:2008 Quality system**.

Our vast client base is spread across all process industry sectors; originally to the likes of the CEGB, BNFL, GEC, British Gas, ICI, BP & Shell, today AMELEC continues to supply quality instrumentation to the Nuclear, Power Generation, Oil & Gas, Chemical, Pharmaceutical, Petrochem, Utilities, Food & Brewery sectors, as well as to many other general manufacturing industries & the Water Authorities throughout.

### Here are some of our clients:



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**Client Feedback**

*"I recently had one of your trip amplifiers go faulty on me. The said item is at least 21 years old, and had been in service for all this time. I was really pleased when you told me that you could supply me with a direct replacement that would not need any modifications done to make it fit. It is very rare for electronic equipment not to be obsolete after a couple of years, never mind 21 years!"*

*In all my dealings with your company I have always been impressed with the quality of your products. The manuals provided with each item are excellent, as is your after sales technical help. I think that your 10 years warranty speaks volumes about your faith in your products. I would never hesitate I recommending your company to anyone"*



*"Many thanks for your prompt response.....Great Service!"*



*"Thanks for the fast response."*



*"Thank you for the great service."*



*"Thanks again for the prompt response."*



*"Thanks for your support."*



*"This is just what we needed, so many many thanks."*



*"Many thanks for your very prompt service...we thank you for helping us on this urgent request, it is much appreciated."*



*"Thank you very much...please say thanks to Oscar & David."*

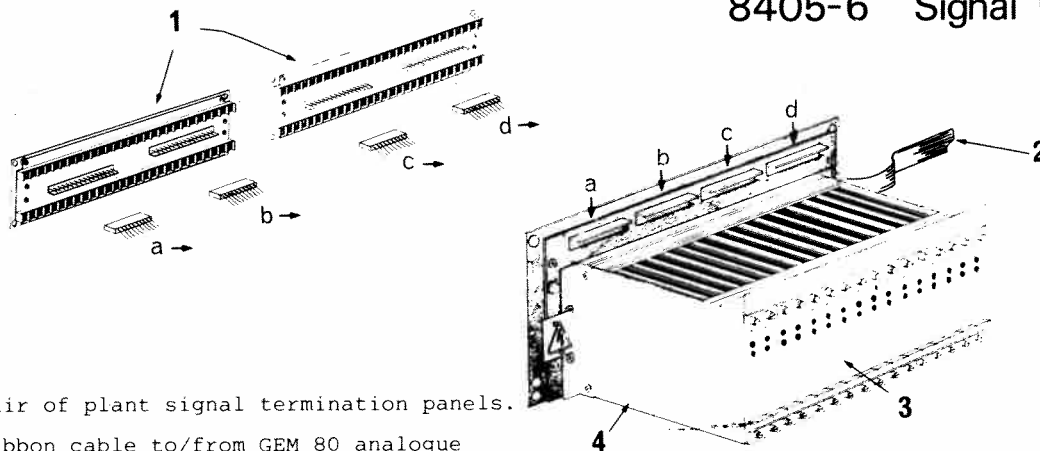


*"I'd like to thank you for your quick response to our request, and for getting the item to us on time"*



*"I just want to say thanks to you and your staff for your speedy response and efforts, received the unit yesterday and works a treat!"*

**8405-6 Signal Conditioning**



1. Pair of plant signal termination panels.
2. Ribbon cable to/from GEM 80 analogue input/output module.
3. Up to 16 signal conditioning modules.
4. Signal conditioning subrack panel.

**DESCRIPTION**

The 8405 signal conditioning equipment is intended for buffering and scaling plant signals to a standard 5V level before they interface with analogue input or analogue output modules on the Fast I/O highway in a GEM 80 controller.

Up to 16 signal conditioning modules, each handling one signal, may be mounted on a signal conditioning panel. One panel connects via ribbon cable to one 16 way analogue input module or to one 16 way analogue output module in a GEM 80 controller. The modules in one signal conditioning panel must be all input modules or all output modules.

In conjunction with 8405 signal conditioning equipments, 8406 termination panel equipments are used for terminating analogue plant signals. Up to 8 analogue signals may be terminated on one 8406 equipment. Each signal may be a 2, 3 or 4 wire signal. Terminals are also provided for the termination of cable screens.

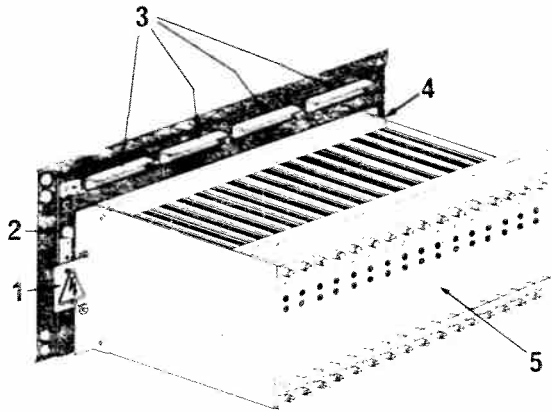
To terminate all of the 16 channels available with an 8405 signal conditioning equipment, two 8406 termination panel equipments are required.

A wide range of module types and calibrations is available for signal conditioning, suitable for interfacing with most industrial process transducers.

**FEATURES**

- Simple wiring connections
- Wide range of signal conditioning modules
- Modules factory pre-calibrated
- Modules mechanically coded by module type
- Non standard calibration available on request

# SIGNAL CONDITIONING SUBRACK PANEL



1. Mains supply terminal block.
2. Supply-on neon indicator.
3. Connectors for wiring to termination panel
4. (Not visible) Ribbon cable connectors for connections to GEM 80 controller subrack.
5. Up to 16 signal conditioning modules.

## SPECIFICATION SUMMARY

Module space	:	For up to 16 modules
	:	Blanking panels available for slots not used
Mains input	:	110V, 50/60Hz, 2W per module
Operating range	:	96 to 130V, 45 to 63Hz
Optional mains input	:	220V, 50/60Hz, operating range 192 to 260V, 45 to 63Hz
Signals from/to GEM 80 controller	:	5V d.c. full scale, via twisted pair ribbon cable
Plant signals	:	Dependent on modules used
	:	1kV isolation voltage
	:	100V maximum signal level
	:	100V maximum voltage between signals
Panel size	:	483mm x 154mm x 223mm (width x height x projection)
Mounting, option 1	:	19" (483mm) rack on 3U mounting centres (where 1U = 44.45mm = 1.75")
Mounting, option 2	:	Using a pair of mounting channels type 8959 at 5U mounting centres

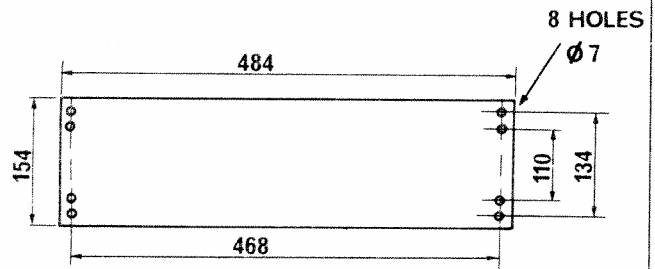
## CONNECTIONS

Mains Supply	:	3 way screw terminal block (for line, neutral and earth)
	:	Accepts wire up to 2.5 sq.mm
Signal connections to GEM 80 controller	:	34 way pin header for twisted pair ribbon cable (17 pairs)
Auxiliary connector*	:	34 way pin header for twisted pair ribbon cable (17 pairs)
Plant connections	:	From 8406 termination panel equipments, via polarised connectors with individual crimped contact inserts
Signal ground*	:	1 way screw terminal block, accepting wire up to 2.5 sq.mm.

\* See Application Notes below for where these connections are required.

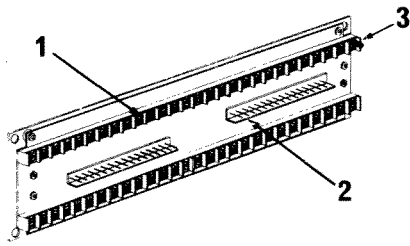
## MOUNTING

Dimensions in millimetres





# PLANT SIGNAL TERMINATION PANEL

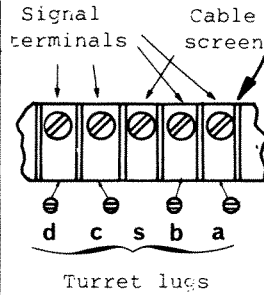
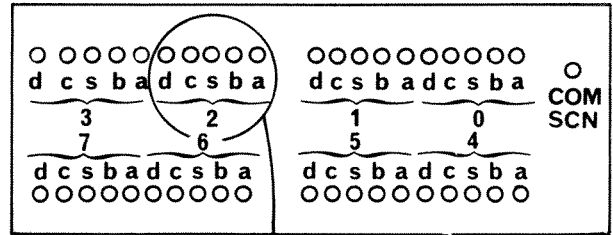


1. Terminals for plant signals and cable screens.
2. Connectors for wiring to signal conditioning subrack panel.
3. Screen common stud.

## SPECIFICATION SUMMARY

Size	:	240mm x 110mm <sup>1</sup>
Mounting	:	Using a pair of mounting channels type 8959 at 4U mounting centres (where 1U = 44.45mm = 1.75")
Terminals	:	Accept wire up to 2.5 sq.mm
Maximum voltages (limited by track clearances on subrack backplane and on termination panels)	:	100V maximum plant signal level 100V maximum voltage between adjacent plant signals
Turret lugs	:	For mounting optional components across adjacent plant terminals 0.6" pitch between adjacent lugs
Number of channels	:	8 Two panels are required per subrack unless it contains 8 modules or less Each channel is suitable for 2, 3 or 4 wire signals
Connections to signal conditioning subrack	:	Polarised connectors with individual crimped contact inserts

## TERMINATION DETAILS



Enlarged diagram of typical channel.

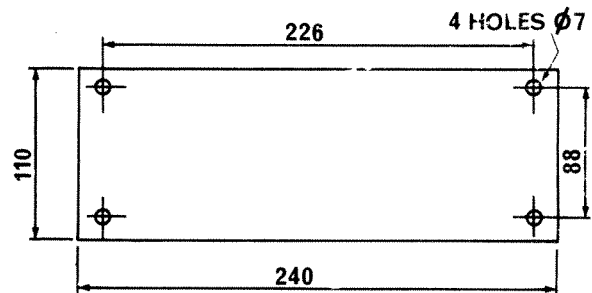
2, 3 or 4 of the signal terminals may be used, depending on module type; see individual module data.

Turret lugs are for optional mounting of components between terminals.

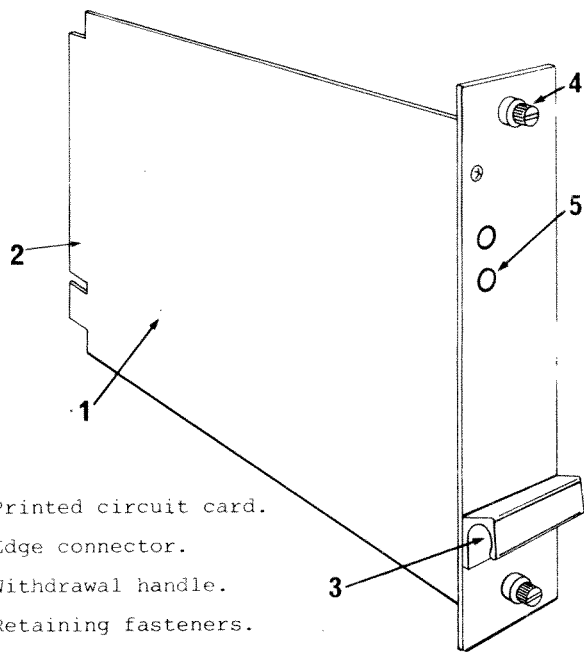
Stud at right hand end of panel labelled COM SCN is the screen common, to be connected to signal ground.

## MOUNTING

Dimensions in millimetres



# SIGNAL CONDITIONING MODULES



1. Printed circuit card.
2. Edge connector.
3. Withdrawal handle.
4. Retaining fasteners.
5. Access to preset span and zero pots

## GENERIC SPECIFICATION

Isolation	: Transformer isolation of mains supply
	: Opto-isolation of input from output
	: Isolation voltages 1kV r.m.s. input to output and mains
Maximum voltages (limited by track clearances on subrack backplane and on termination panel)	: 100V maximum plant signal level
	: 100V maximum voltage between adjacent plant signals
Module dimensions	: 0.8" (20mm) wide; up to 16 can be accommodated in one subrack panel
Temperature	: -20 to +60°C operating -40 to +80°C storage
Humidity	: 5 to 95%
Interface signal level to GEM 80 controller	: 5V full scale
Output ripple	: <0.3% of span r.m.s. at modulation frequency (250Hz approx)

## ACCURACIES

Initial calibration	: See individual module specifications
Warm up time	: 60 minutes with correct input and output loads to achieve stated accuracy
Temperature effects for a 10°C change in ambient temperature	: Change in span: ±0.2% of span
	: Change in zero: ±0.1% of span
	: Change in elevation: ±0.1% of elevation (applies to modules where zero input is to produce a non-zero output)
Stability with time	: Over 24 hours: ±0.05% of span
	: Over 1 year: ±0.1% of span

Note: Module outputs are single-ended. Some falling off in accuracy occurs when output is close to 0V. To achieve quoted accuracies over the full output range this should have elevated zero, e.g. 1-5V rather than 0-5V.

## DETAILED SPECIFICATION

All modules are factory calibrated. For ordering purposes, a further four digits are appended to the module type No. to define the particular calibration (see "Ordering" at the end of this leaflet). The specifications below define what range of calibrations is available.

### 8410 E.M.F./THERMOCOUPLE INPUT MODULE

Input span	: 0-5mV up to 0-120mV
Calibration accuracy	: ±0.1%
Source resistance	: 1kohm max. for specified performance
Zero suppression	: -25% to +400% of span
Input impedance	: >1Mohm with upscale drive on open circuit
Open circuit response	: Upscale standard
	: Downscale non-preferred option (lower input impedance)
Time response	: Approximates to three time constants in cascade
	: Input filter 100ms
	: Two output filters of 50ms each

For thermocouple versions only:-

Cold junction compensation (deviation from 20°C) : 0.7µV/°C for platinum/platinum rhodium thermocouples  
: 1.5µV/°C for copper/constantan, iron/constantan and chromel/alumel

Maximum error for 0 to 70°C cold junction variation : 18µV for platinum/platinum rhodium  
: 40µV for copper/constantan, iron/constantan and chromel/alumel

Accuracy class to BS.6175:1982 : 0.2 (based on SIRA test results)

#### 8420 RESISTANCE THERMOMETER INPUT MODULE

Input span : 2 ohms up to 1kohm

Calibration accuracy : ±0.1% of span

Zero suppression : 0 to 90% of span

Source resistance : 100 ohms max/line for specified performance

Open circuit response : Upscale only

Time response : Approximates to three time constants in cascade  
: Input filter 100ms  
: Two output filters of 50ms each

Accuracy class to BS.6175:1982 : 0.2 (based on SIRA test results)

#### 8430 PROCESS CONTROL SIGNAL INPUT MODULE

Input span : 0-400mV up to 0-100V for voltage signal versions  
: 0-4mA up to 0-20mA for current signal versions

Calibration accuracy : ±0.1% of span

Zero suppression : -50% to +50% of span

Input impedance : >1Mohm (voltage input versions)  
: Shunt resistance chosen to drop approx.400mV (current input versions)

Open circuit response : Downscale only

Time response : Approximates to three time constants in cascade  
: Input filter 100ms  
: Two output filters of 50ms each

#### 8431 PROCESS CONTROL SIGNAL OUTPUT MODULE

Output span : 0-4mA up to 0-20mA for current output signal versions  
: 0-1V up to 0-10V for voltage output signal versions  
: Unidirectional outputs only

Calibration accuracy : ±0.1% of span

Zero suppression : -50% to +50% of span

Open circuit response : Downscale only (i.e. open circuit connection from GEM 80 controller)

Output voltage drive : 10V max. for normal operating conditions (current output versions)  
: 28V max for open circuit output

Time response : Approximates to three time constants in cascade  
: Input filter 100ms  
: Two output filters of 50ms each

#### 8440 SLIDEWIRE INPUT MODULE

Input span : 0-100 ohms up to 0-5kohms

Calibration accuracy : ±0.1% of span

Zero suppression : 0 to 50% of span

Line resistance : 100 ohms/line max for specified performance

Open circuit response : Upscale only

Time response : Approximates to three time constants in cascade  
: Input filter 100ms  
: Two output filters of 50ms each



8450 A.C. VOLTS/CURRENT INPUT MODULE

Input span (approx) : 0-1V for voltage  
(Module is calibrated : input version standard  
relative to primary : 0-2mA for current  
of test transformer) : input version standard

Transformers for use : Standard transformers  
in conjunction with : are for full scale  
this module : voltages of 150V, 300V  
and 600V and for full  
scale currents of 1A  
and 5A

: Mounting on 8408  
transformer termination  
panel

: Zeners for CT open  
circuit protection

Calibration accuracy :  $\pm 0.5\%$  of span for  
module only

Effective transformer :  $\pm 1.0\%$   
turns ratio accuracy

Zero suppression : 0 to +50% of span

Open circuit response : Downscale only

Waveform dependence : Calibration assumes that  
the input is sinusoidal.  
Output is proportional  
to the mean value of the  
input waveform after  
rectification

Time response : Approximates to five  
time constants in  
cascade

: Three input filters of  
10ms each

: Two output filters of  
50ms each

8460 PROCESS CONTROL SIGNAL INPUT MODULE WITH  
CURRENT SOURCE

Input span : 0-4mA up to 0-20mA

Calibration accuracy :  $\pm 0.1\%$  of span

Zero suppression : -50% to +50% of span

Input impedance : Shunt resistance chosen  
to drop approx. 400mV

Open circuit response : Downscale only

Current source output : open circuit voltage  
voltage drive : pre-settable from 2V  
to 24V

: Regulation  $\pm 0.2\%$  at  
20mA

: 22m $\Omega$  foldback current  
limit

Time response : Approximates to three  
time constants in  
cascade

: Input filter 100ms

: Two output filters of  
50ms each

8470 STRAIN GAUGE INPUT MODULE

(details to follow)

8480 PULSE TRAIN INPUT MODULE

(details to follow)

8490 NON ISOLATED INPUT MODULE

Function : Simple passive circuits  
for earth-free signals

Configuration : Pi network, allowing  
for potential divider  
and current shunt  
circuits

Calibration accuracy :  $\pm 0.1\%$  of span

Zero suppression : Not available

Open circuit response : Downscale only

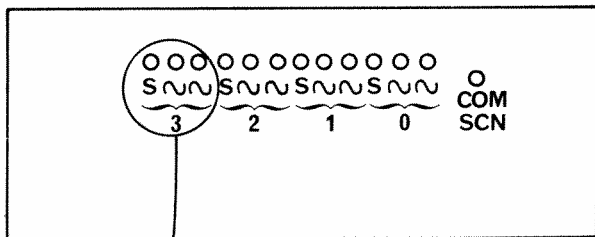
# 8408 TRANSFORMER TERMINATION PANEL

(For mounting CT's and VT's used in conjunction with 8450 A.C: Volts/Current input modules)

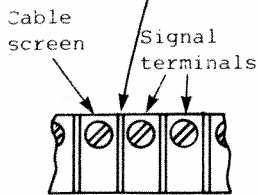
## SPECIFICATION SUMMARY

- Size : 240mm x 110mm
- Mounting : Using a pair of mounting channels type 8959 at 4U mounting centres (where 1U = 44.45mm = 1.75")
- Terminals : Accept wire up to 2.5 sq.mm
- Connections to signal conditioning subrack : Polarised connectors with individual crimped contact inserts
- Number of channels : 4
  - : Logically equivalent to half a plant signal termination panel
- Transformers : Accommodates one transformer per channel (may be either a VT or a CT)
- Open circuit protection : Zener Diodes are fitted with current transformers to limit the voltages which would occur if a connector or module were inadvertently unplugged

## TERMINATION DETAILS



Enlarged diagram of typical channel.

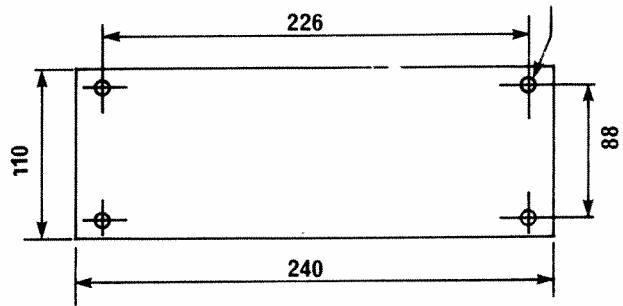


Stud at right hand end of panel labelled COM SCN is the screen common, to be connected to signal ground.

## MOUNTING

Dimensions in Millimetres

4 HOLES  $\varnothing$  7



### TERMINAL NUMBERS

Each module has a 12 way edge connector. The edge connector contacts are utilised as follows:

- 1 to 4 : Plant signals
- 5 : Earth
- 6 : Line
- 7 : Neutral
- 8 : Earth
- 9 & 10 : Not connected
- 11 : Signal to/from GEM 80 controller(-)
- 12 : Signal to/from GEM 80 controller(+)

When connected to 8406 termination equipments in the standard manner (see later), edge connector contacts 1,2,3 & 4 are brought out to terminals a,b,c & d respectively on the termination panel for the particular channel.

The usage of the a,b,c & d terminals within a channel depends on the type of module used on that channel; and is as below:

Module type	Terminal a	Terminal b	Terminal c	Terminal d
8410	I/P (+)	I/P (-)	n.c.	n.c.
8420	I/P (+)	I/P (-)	Comp.	n.c.
8430	I/P (+)	I/P (-)	n.c.	n.c.
8431	n.c.	n.c.	O/P (+)	O/P (-)
8440	Source(+)	Slider	Source(-)	n.c.
8450	I/P (⊘)	I/P (⊘)	n.c.	n.c.
8460	I/P (+)	I/P (-)	Excit (+)	Excit (-)
8470	I/P (+)	I/P (-)	Excit(+)	Excit(-)
8480	I/P (+)	I/P (-)	n.c.	n.c.
8490	I/P (+)	I/P (-)	n.c.	n.c.

n.c. = not connected

See application notes for use of n.c. terminals with turret lug mounted components.

### MECHANICAL CODING

Modules are mechanically coded to protect against electrical damage only. Each module has a polarising slot cut between edge connector contact fingers as given in the table below. Each subrack is supplied with a corresponding polarising key in each edge connector socket. These keys may be inserted in the edge connector mouldings in the appropriate positions between contacts to suit the modules to be used. These positions are as follows:

Module type	Polarising key between edge connector contact Nos:
8410	3 & 4
8420	3 & 4
8430	4 & 5
8431	10 & 11
8440	3 & 4
8450	8 & 9
8460	9 & 10
8470	9 & 10
8480	4 & 5
8490	7 & 8

### CHANNEL NUMBERS

#### 8405 SUBRACK PANEL EQUIPMENT

One subrack panel equipment can be fitted with up to 16 signal conditioning modules. The subrack is labelled with numbers above the modules of their slot/channel numbers, from 0 at the left hand side to 15 at the right hand side.

On the panel above the subrack are four plugs, each handling 4 channels, each with a different polarising key position, as follows:

- Plug 1 : Channels 0 to 3 : Key at pin 1
- Plug 2 : Channels 4 to 7 : Key at pin 2
- Plug 3 : Channels 8 to 11 : Key at pin 3
- Plug 4 : Channels 12 to 15: Key at pin 4

#### 8406 TERMINATION PANEL EQUIPMENT

One termination panel equipment can handle up to 8 channels. For one 8405 subrack panel equipment, two 8406 termination panel equipments are therefore required to service all 16 channels.

A termination panel carries two plugs, each handling 4 channels, each with a different polarising key position, as follows:

- Plug 1 : Channels 0 to 3 : Key at pin 5
- Plug 2 : Channels 4 to 7 : Key at pin 6

#### 8408 TRANSFORMER TERMINATION PANEL

One transformer termination panel handles up to 4 channels, and is logically equivalent to half an 8406 termination panel. It is used in place of half an 8406 where step-down CT's or VT's are to be used to feed type 8450 a.c. voltage or current input modules.

A transformer termination panel carries only one plug. The polarising key position may be chosen as either pin 5 or pin 6, depending on which half of an 8406 the panel is used in place of.

#### CHANNEL NUMBER SUMMARY TABLE:

Subrack	Channel Nos.	Plug Nos.	Term. Panel	Channel Nos.	Plug Nos.	Transformer Alternative	Channel Nos.	Plug Nos.	Standard cable ordering codes
8405	0-3	PL1	1st 8406	0-3	PL1	8408	0-3	PL1*	8891-4062
	4-7	PL2		4-7	PL2		0-3	PL1†	8891-4063
	8-11	PL3	2nd 8406	0-3	PL1	8408	0-3	PL1*	8891-4064
	12-15	PL4		4-7	PL2		0-3	PL1†	8891-4065

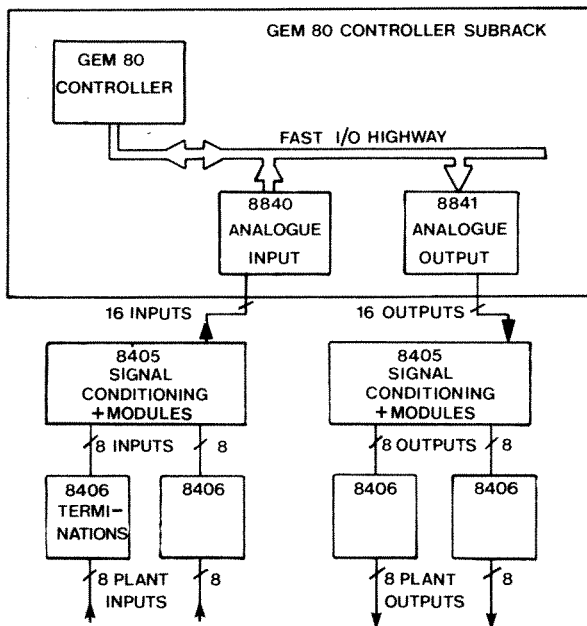
\* Polarising key pin 5 †Polarising key pin 6

## APPLICATION NOTES

### 1. EXAMPLE

The diagram below indicates the way in which signal conditioning equipment interfaces plant signals with a GEM 80 controller.

In this example, only one 8840 analogue input and one 8841 analogue output equipments are shown connected to the Fast I/O highway. In practice, there could be several of each, depending on the application and the size of the GEM 80 controller.



### 2. ACCURACY

The overall accuracy of any signal channel will depend on the accuracy of the signal conditioning module used, and also on the accuracy of the analogue input or output module in the GEM 80 controller subrack. For signal conditioning module accuracies, see above; for analogue input and output equipments used in GEM 80 controller subracks, see separate leaflets.

### 3. SCALING

When used with signal conditioning equipment, the analogue input and output equipments ordered must be chosen for 5V input and output and excluding termination panels; see ordering below. With these, a 5V signal will correspond to a value of 32000 in the GEM 80 Control Language program.

Errors and offsets in process transducers, and from plant cabling and connectors, should be compensated for in the program, e.g. using the linear conversion special function S11 (LINCON).

### 4. RESOLUTION

Within the GEM 80 controller, analogue signals are converted into corresponding digital values, or vice versa. A quantising error arises in this conversion. The quantum is the value 16, or 1 part in 2000 of full scale.

### 5. OUT-OF-RANGE INPUTS

Most process transducers provide input signals with an elevated zero, so that a signal is present when the process variable has zero value. Commonly used signal ranges are 4-20mA, 1-5mA, 1-5V etc. It is then possible to detect for loss of input signal due to transducer malfunction, broken wires etc.

In a similar manner, signals from signal conditioning input modules to the GEM 80 controller are normally calibrated to provide a signal in the range 1-5V into any analogue input module in the GEM 80 controller. The corresponding values in the GEM 80 Control Language program will then be in the range 6400 to 32000. Checks can be incorporated in the program to take appropriate action if input values fall outside this range.

### 6. NON-LINEAR INPUTS AND OUTPUTS

Many process control transducers do not provide signals which are directly proportional to the process variable being measured. For instance, the mV output from thermocouples can only be treated as linear over restricted temperature ranges.

Linearisation can be incorporated in the GEM 80 Control Language program using special functions such as the function generator S30 (FGEN) or, in some cases, the square root S12 (SQRT).

Similarly, non-linear outputs, such as valve characteristics, can be linearised in the GEM 80 Control Language program.

### 7. DATA TABLE LOCATIONS

With an 8405 signal conditioning equipment fitted with 16 signal conditioning input modules, the 16 signals pass on, after having been conditioned, to an 8840 analogue input equipment in the GEM 80 controller. Within the controller, they are converted to digital values, and held in memory in the C table, in a block of 16 locations. The numbering of these locations depends on the type of GEM 80 controller used and on the position within it of the 8840 analogue input equipment; see appropriate leaflets.

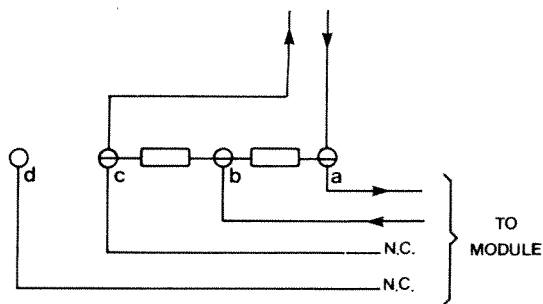
Similarly, plant outputs are determined by the values held in memory in a block of 16 locations in the D table for each 8841 analogue output equipment, from which signals pass to the plant via signal conditioning output modules in 8405 signal conditioning equipments. The numbering of the D table locations will, again, depend on the type of GEM 80 controller and the position within it of the 8841 analogue output equipments (see appropriate leaflets).

## 8. USE OF TURRET LUGS ON TERMINATION PANELS

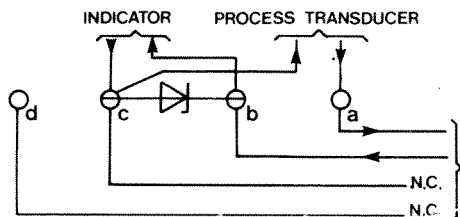
With input modules, most types require 2-wire inputs. In this case, only terminals a and b are used for the particular channel serviced by the module on the termination panel, and terminals c and d are not-connected (see table on page 7).

In conjunction with the not connected terminals, turret lug mounted components may optionally be fitted.

### EXAMPLE OF A POTENTIAL DIVIDER:



Example of a process transducer providing a current output in a series connection with an indicator, with zener limiting of the voltage across the indicator:



Note, that the pitch between turret lugs is 0.6" (15mm) and that two component tails may be mounted in one turret lug, as in the potential divider example above.

## 9. SIGNAL GROUNDING OF ANALOGUE INPUTS

With plant input signals, the signal conditioning modules provide corresponding output signals to the GEM 80 controller which are floating with respect to ground. However, the analogue input equipment type 8840 in the GEM 80 controller has differentially connected inputs, and does not tie the signals to ground either. To prevent the signals between the signal conditioning modules and the GEM 80 controller drifting about, it is therefore necessary to connect one side of them to signal ground. A 1-way terminal block is provided on the signal conditioning subrack panel to allow this connection to be made, which is common to all 16 channels.

Note, however, that a signal ground connection to this terminal block must not be made on signal conditioning subracks used for plant output signals. This is because the signals between GEM 80 controllers and signal conditioning modules already have one side connected to signal ground when fed from type 8841 analogue output equipments; a further signal ground connection from the 1 way terminal block would, in this case create an earth loop, with consequent noise problems.

## 10. AUXILIARY RIBBON CABLE CONNECTOR

On signal conditioning subrack panels, there is fitted a second ribbon cable pin header labelled "AUX", the pins of which are commoned to the corresponding pins on the pin header labelled "GEM 80". The latter connector is the one which terminates the ribbon cable connection to the GEM 80 controller. The auxiliary connector may be made use of for connections to indicators, etc. The mating socket for this pin header may either be of the insulation displacement type with ribbon cable, or a type with individual crimped contacts with separate wires.

Note: One possible use for the auxiliary connector is for looping between an output subrack panel and an input subrack panel, where output signals are to be monitored by looping back to input equipments. In this case, because a signal ground connection is already present on the output panel, no signal ground connection is required on the input panel 1 way terminal block, as this would cause an earth loop.

## 11. COLD JUNCTION COMPENSATION ON THERMOCOUPLE INPUT MODULES TYPE 8410

Versions of type 8410 module which are scaled for use with thermocouples include cold junction compensation circuits. However, this compensation is only strictly correct if the junction between the thermocouple compensating leads from the plant and copper wiring and printed circuit track is at the same temperature as the 8410 module on which the compensation circuits are fitted.

To obtain the accuracies quoted in the module specification given earlier, it is desirable for the thermocouple compensating leads to extend as close as possible to the module, i.e. the wiring between termination panels and the subrack panel should be in compensating wire.

In practice, the additional error caused by using normal copper wire between termination panels and subrack panels will be negligible in most cases. However, if termination panels are some distance from subrack panels, such that a difference in local ambient temperature between the panels will occur which is comparable with the temperature span to be measured by the thermocouple, then it may be desirable to run leads in compensating wire between the panels.

Since, in most applications, termination panels are not mounted very far away from their subrack panels, GEC supply interconnections in copper wire as standard. Any other type of wiring must be specified if required on the application.

# ORDERING CODES

## 1. EQUIPMENT

### SUBRACK EQUIPMENTS:

Each of the following consists of:-

Signal conditioning subrack panel; Mounting screws, etc.;	Ordering Code
Labels	
Signal conditioning equipment, 110V supply, for 16 signals	8405-4011
Signal conditioning equipment, 220V supply, for 16 signals	8405-4012

### TERMINATION PANEL EQUIPMENTS:

The following consists of:-

Signal termination panel; Mounting screws and labels etc.	
Termination panel equipment (with no turret lug mounted components)	8406-4011
Termination panel equipment (with specified turret lug mounted components)	Contact GEC for details

### SIGNAL CONDITIONING MODULES:

The range of calibrations is continually being added to. See appendix sheet for those available at the date of issue.

### BLANK FRONT PANELS:

To cover any module slot not used in a signal conditioning subrack	8409
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### TRANSFORMER TERMINATION PANELS:

Transformer termination panel with specified CT's and/or VT's	Contact GEC for details
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### STANDARD INTERCONNECTION LEADS:

For connecting termination panels to subrack panels; length 2 metres unless otherwise specified.

For channels 0 to 3	8891-4062
For channels 4 to 7	8891-4063
For channels 8 to 11	8891-4064
For channels 12 to 15	8891-4065

## 2. SPARES

Ordering  
code

Subrack panel, 110V supply, for 16 modules	8402-4001
Subrack panel, 220V supply, for 16 modules	8402-4002
Termination panel (with no turret lug mounted components)	8403-4001
Termination panel (with specified turret lug mounted components)	Contact GEC
Signal conditioning modules	See Appendix
Set of 2 contact housings, 32 crimp contacts, and 2 polarising keys (for making up special interconnecting leads)	8890-4032

## 3. ASSOCIATED EQUIPMENT

8840 Analogue Input equipment, excluding termination panel, for ±5V signals	8840-4022
8841 Analogue Output equipment, excluding termination panel, for ±5V signals	8841-4002
Mounting kit comprising one length of steel channel with cable clips	8959



# AMELEC

*SIGNAL CONDITIONING*

## AMELEC AH-GEM 700 Series I/O Signal Conditioning

The AMELEC AH-GEM 700 series is a comprehensive range of I/O Cards that are suitable for upgrade / replacement of original GEM80 8410 / 8420 / 8430 / 8431 / 8450 / 8560 series Temperature and Process input / output signal conditioning cards.

The replacement cards are hot-swappable & easily interchangeable\* and come with the AMELEC standard 10 year guarantee. So you can be rest assured that the quality is second to none.

Scanning the QR codes below will enable you to download our general datasheets. So wherever you are on site/plant, they are easy accessible straight from your mobile. Further datasheets for specific model no. replacements are available on request e.g. 8410-4074 / 8431-4001

(\* The only change required to upgrade your exiting 8405 Series I/O sub-rack would be a 24Vdc Power Supply to the sub-rack termination panel as opposed to the old 110/240Vac supply options0.)

iPhone users: Download "QR Reader for iPhone" Free app

Android users: Download "Barcode Scanner" Free app

Blackberry users: Download "ScanLife Barcode Reader" Free app

For Other users: Go to [www.mobile-barcodes.com/qr-code-software](http://www.mobile-barcodes.com/qr-code-software)



**8410 Series  
Equivalent  
datasheet**



**8420 Series  
Equivalent  
datasheet**



**8430/31 Series  
Equivalent  
datasheet**



**8460 Series  
Equivalent  
datasheet**



**UVDB Verify**  
empowered by Achilles



**SIL RATING**  
1, 2 & 3  
IEC61508



## AH-GEM 710 Thermocouple Temperature Transmitter

- Suitable for Upgrade/Replacement of original GEM80 8410 series Temperature input signal conditioning cards
- Supply voltage 21 to 30Vdc (new 24Vdc supply required to the original 8405 series Subrack)
- Amelec standard 10 year guarantee
- Suitable for SIL Level 1, 2, & 3 (IEC 61508-2)

### TECHNICAL SPECIFICATION

#### FUNCTION

Temperature input signal Converter / Isolator

#### INPUT

Can be configured to accept mV signal from thermocouple Type S, R, B, J, K, T, E, N and other special types also available on request.

Automatic Cold Junction compensation fitted as standard.

Typical input: 0 – 500 Deg °C / TC type “K”

#### OUTPUT

DC current or voltage specified in the range of:  
 Current up to 100mA max in Sink configuration (externally powered)  
 Current up 22mA max Source configuration (Internally powered)  
 Typical output ranges: 0-5V, 1-5V, 0-10V, 4-20mA (Source)

#### CONTROLS

Zero / Span: 15 turn potentiometers to calibrate Output.

#### INDICATOR

Amber Led: power ON indicator

#### PERFORMANCE

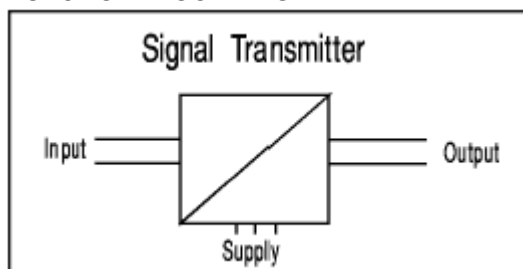
Response time: Typically < 400mS  
 Linearity :  $\pm 0.1\%$

#### PROTECTION

Isolation 1000V RMS\*. Input/Output/Supply  
 Internal Fuse.  
 Fail safe on loss of power  
 Input over range typically at 300%.  
 Output saturation 125%.



#### FUNCTION BLOCK DIAGRAM



#### ENVIRONMENTAL CONDITION

Storage temperature: - 40 to +70 °C  
 Operating Ambient: -15 to +55 °C  
 Relative Humidity: 5 to 95% RH

#### MOUNTING / DIMENSION

Card 3U high 4E wide  
 Mounting: Existing 16way GEM80 8405 series subrack  
 Card weight < 200g

#### ADD ON / OPTIONS

J : Input injection jack socket  
 P: Test point (Trip set point monitoring)  
 Non standard Power supply ranges available

## AH-GEM 720 RTD Temperature Transmitter

- Suitable for Upgrade/Replacement of original GEM80 8420 series Temperature input signal conditioning cards
- Supply voltage 21 to 30Vdc (new 24Vdc supply required to the original 8405 series Subrack)
- Amelec standard 10 year guarantee
- Suitable for SIL Level 1, 2, & 3 (IEC 61508-2)

### TECHNICAL SPECIFICATION

#### FUNCTION

Temperature input signal Converter / Isolator

#### INPUT

Can be configured to accept 2 or 3-wire PT100 Resistance thermometer inputs (PT1000 RTD input also available on request).

Typical input: 0 – 100 Deg °C / 3-wire

#### OUTPUT

DC current or voltage specified in the range of:  
 Current up to 100mA max in Sink configuration (externally powered)  
 Current up 22mA max Source configuration (Internally powered)  
 Typical output ranges: 0-5V, 1-5V, 0-10V, 4-20mA (Source)

#### CONTROLS

Zero / Span: 15 turn potentiometers to calibrate Output.

#### INDICATOR

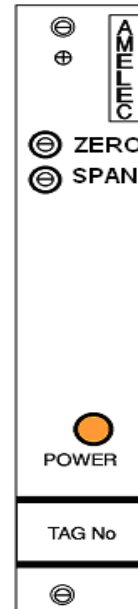
Amber Led: power ON indicator

#### PERFORMANCE

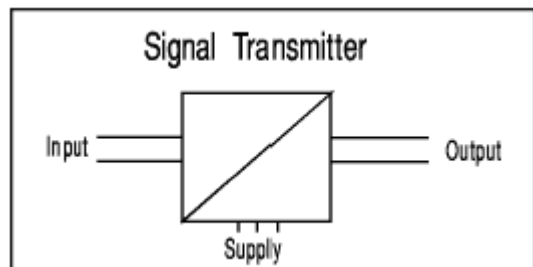
Response time: Typically < 400mS  
 Linearity : ±0.1%

#### PROTECTION

Isolation 1000V RMS\*. Input/Output/Supply  
 Internal Fuse.  
 Fail safe on loss of power  
 Input over range typically at 300%.  
 Output saturation 125%.



#### FUNCTION BLOCK DIAGRAM



#### ENVIROMENTAL CONDITION

Storage temperature: - 40 to +70 °C  
 Operating Ambient: -15 to +55 °C  
 Relative Humidity: 5 to 95% RH

#### MOUNTING / DIMENSION

Card 3U high 4E wide  
 Mounting: Existing 16way GEM80 8405 series subrack  
 Card weight < 200g

#### ADD ON / OPTIONS

P: Test Point (output monitoring)  
 Non standard Power supply ranges available

## AH-GEM 730 Process Signal Transmitter

- Suitable for Upgrade/Replacement of original GEM80 8430 & 8431 series I/O signal conditioning cards
- Supply voltage 21 to 30Vdc (new 24Vdc supply required to the original 8405 series Subrack)
- Amelec standard 10 year guarantee
- Suitable for SIL Level 1, 2, & 3 (IEC 61508-2)

### TECHNICAL SPECIFICATION

#### FUNCTION

Process Input / Output Signal Converter / Isolator

#### INPUT

DC Current / Voltage can be specified in the range of:  
Current up to 100mA max (Passive)  
Voltage 0.4 to 100V max

Typical inputs: 0-5V, 1-5V, 0-10V, 0-10mA, 4-20mA

#### OUTPUT

DC current or voltage specified in the range of:  
Current up to 100mA max in Sink configuration (externally powered)  
Current up 22mA max Source configuration (Internally powered)  
Typical output ranges: 0-5V, 1-5V, 0-10V, 4-20mA (Source)

#### CONTROLS

Zero / Span: 15 turn potentiometers to calibrate Output.

#### INDICATOR

Amber Led: power ON indicator

#### PERFORMANCE

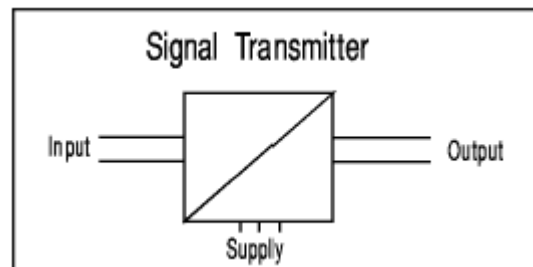
Response time: Typically < 400mS  
Linearity :  $\pm 0.1\%$

#### PROTECTION

Isolation 1000V RMS\*. Input/Output/Supply  
Internal Fuse.  
Fail safe on loss of power  
Input over range typically at 300%.  
Output saturation 125%.



#### FUNCTION BLOCK DIAGRAM



#### ENVIRONMENTAL CONDITION

Storage temperature: - 40 to +70 °C  
Operating Ambient: -15 to +55 °C  
Relative Humidity: 5 to 95% RH

#### MOUNTING / DIMENSION

Card 3U high 4E wide  
Mounting: Existing 16way GEM80 8405 series subrack  
Card weight < 200g

#### ADD ON / OPTIONS

M: Input loop Excitation (@ 10V / 24Vdc, as per 8460 series)  
J: Input injection Jack  
P: Test Point (output monitoring)  
Non standard Power supply ranges available

## AH-GEM 730M Process Signal Transmitter

- Suitable for Upgrade/Replacement of original GEM80 8460 series I/O signal conditioning cards
- Supply voltage 21 to 30Vdc (new 24Vdc supply required to the original 8405 series Subrack)
- Amelec standard 10 year guarantee
- Suitable for SIL Level 1, 2, & 3 (IEC 61508-2)

### TECHNICAL SPECIFICATION

#### FUNCTION

Process Input / Output Signal Converter / Isolator

#### INPUT

DC Current input ranges :

Typical inputs: 0--20mA / 4-20mA, with 10V or 24Vdc 2-wire input loop Excitation

#### OUTPUT

DC current or voltage specified in the range of:  
 Current up to 100mA max in Sink configuration (externally powered)  
 Current up 22mA max Source configuration (Internally powered)  
 Typical output ranges: 0-5V, 1-5V, 0-10V, 4-20mA (Source)

#### CONTROLS

Zero / Span: 15 turn potentiometers to calibrate Output.

#### INDICATOR

Amber Led: power ON indicator

#### PERFORMANCE

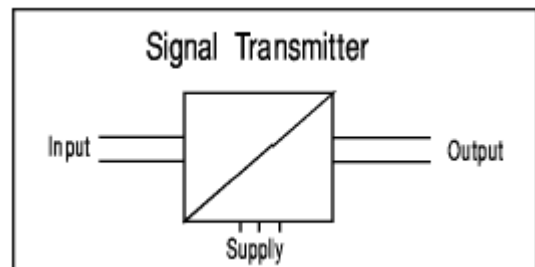
Response time: Typically < 400mS  
 Linearity :  $\pm 0.1\%$

#### PROTECTION

Isolation 1000V RMS\*. Input/Output/Supply  
 Internal Fuse.  
 Fail safe on loss of power  
 Input over range typically at 300%.  
 Output saturation 125%.



#### FUNCTION BLOCK DIAGRAM



#### ENVIRONMENTAL CONDITION

Storage temperature: - 40 to +70 °C  
 Operating Ambient: -15 to +55 °C  
 Relative Humidity: 5 to 95% RH

#### MOUNTING / DIMENSION

Card 3U high 4E wide  
 Mounting: Existing 16way GEM80 8405 series subrack  
 Card weight < 200g

#### ADD ON / OPTIONS

J: Input injection Jack  
 P: Test Point (output monitoring)  
 Non standard Power supply ranges available