# OPERATING INSTRUCTIONS
# US EDITION
## GDU
## 27-1500

| | | |
|---|---|---|
| **ELE International**<br>Chartmoor Road, Chartwell Business Park<br>Leighton Buzzard, Bedfordshire, LU7 4WG<br>England<br>phone: +44 (0) 1525 249200<br>fax: +44 (0) 1525 249249<br>email: ele@eleint.co.uk<br>http://www.ele.com<br>ELE International, a division of Hach Lange Ltd. | **Distributor:** | **ELE International**<br>Soiltest Product Division<br>PO Box 389, Loveland, CO 80539<br>USA<br>phone: +1 (800) 323 1242<br>fax: +1 (970) 663 9781<br>email: soiltest@eleusa.com<br>http://www.eleusa.com |

*In the interests of improving and updating its equipment, ELE reserves the right to alter specifications to equipment at any time*
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**Contents**

# 1 INTRODUCTION AND SPECIFICATION

The GDU is a versatile instrument designed to accommodate the general logging requirements of geotechnical engineers and scientists. Its intelligent interface allows the user to work with a range of transducers that are common requirements for a range of geotechnical tests. The GDU itself may be connected to any standard personal computer via an RS232 interface.

## 1.1 Use of this Manual

This manual has not been written with the technical user in mind, that is, someone who intends to write their own software to control the GDU and therefore needs to know about the GDU Data acquisition Operating System command set (GDOS commands). This user should refer to the GDU/GDOS Technical Manual 9901X0264.

## 1.2 General Information

In no event will the manufacturer be liable for direct, indirect, special, incidental, or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are available on the manufacturer's website.

### 1.2.1 Safety Information

| *NOTICE* |
| --- |
| The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and claims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during possible equipment malfunction. |
| *AVIS* |
| Le fabricant décline toute responsabilité quant aux dégâts liés à une application ou un usage inappropriés de ce produit, y compris, sans toutefois s'y limiter, des dommages directs ou indirects, ainsi que des dommages consécutifs, et rejette toute responsabilité quant à ces dommages dans la mesure où la loi applicable le permet. L'utilisateur est seul responsable de la vérification des risques d'application critiques et de la mise en place de mécanismes de protection des processus en cas de défaillance de l'équipement. |

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

S'il vous plaît lire l'intégralité de ce manuel avant de déballer, d'installer ou d'utiliser cet équipement. Faites attention à tous les dangers et mises en garde. Ne pas le faire pourrait entraîner des blessures graves de l'opérateur ou des dommages à l'équipement.

Assurez-vous que la protection assurée par cet équipement ne soit pas compromise. Ne pas utiliser ou installer cet équipement d'une manière autre que celle spécifiée dans ce manuel.

| ⚠ DANGER |
|---|
| Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury. |
| ⚠ DANGER |
| Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, entraînera la mort ou des blessures graves. |

| ⚠ WARNING |
|---|
| Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury. |
| ⚠ AVERTISSEMENT |
| Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, pourrait entraîner la mort ou des blessures graves. |

| ⚠ CAUTION |
|---|
| Indicates a potentially hazardous situation that may result in minor or moderate injury. |
| ⚠ ATTENTION |
| Indique une situation potentiellement dangereuse qui peut entraîner des blessures mineures ou modérées. |

| NOTICE |
|---|
| Indicates a situation which, if not avoided, may damage the instrument. Information that requires special emphasis. |
| AVIS |
| Indique une situation qui, si elle n'est pas évitée, peut endommager l'instrument. L'information qui nécessite une attention particulière. |

### 1.2.2 Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

| | |
|---|---|
|  | This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information. |
|  | Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 of August 2005. In conformity with European local and national regulations (EU Directive 2012/19/EU). European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user.<br><br>***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.* |

| | |
|---|---|
|  | Ce symbole, s'il est apposé sur l'instrument, fait référence au manuel d'instructions de fonctionnement et / ou de sécurité. |

## 1.3 Certification

**Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A**

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

**FCC Part 15, Class 'A' Limits**

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions.

1. The Equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:
1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.

5. Try combinations of the above.

## 1.4 Electrical Safety

Warning : With the exception of the slot in CPU and Analogue Input Modules, the unit does not contain any user-serviceable parts.

Avertissement: À l'exception de la fente CPU et des modules d'entrées analogiques, l'appareil ne contient aucune pièce réparable par l'utilisateur.

- Do NOT attempt to open the case as dangerous voltages are present internally.
- Ne pas essayer d'ouvrir le boîtier que les tensions dangereuses sont présentes à l'intérieur.
- Do NOT operate the unit if the supply cord appears damaged.
- NE PAS utiliser l'équipement si le cordon d'alimentation semble être endommagé.

- Only connect the equipment to a polarised earthed power socket.
- Ne branchez l'équipement qu'à une prise de courant mise à la terre polarisée.
- Switch off and unplug the equipment before cleaning.
- Eteignez et débranchez l'équipement avant de le nettoyer.

## 1.5 The GDU Operating System

The GDU Data acquisition Operating System (GDOS) is the GDU control software that runs in the GDU's CPU. It is able to interpret the English-like commands (GDOS commands) sent from a computer. These GDOS commands are used to configure the GDU for data acquisition and control and additionally may be used to interrogate the operating conditions of the GDU and recall logged data. Refer to the GDU Technical Manual for details on the command syntax.

### 1.5.1 CPU Module

The GDU mainframe accepts one CPU module with its RS232 and Ethernet interfaces. The module contains a microprocessor with the GDU operating system GDOS. The on-board clock provides a 24 hour clock and calendar. It resides in the 5$^{th}$ slot to the far right-hand side of the chassis. It should not be inserted in any other positions. The Ethernet interface should only be connected to a host PC via an appropriate router.

### 1.5.2 Analogue Input Module

The GDU mainframe has four slots (slots 1 to 4) which can accept the analogue input modules. The system can address up to 32 individual input channels where one channel normally corresponds to one analogue input.

Each input module accepts up to eight analogue inputs. It also has a dedicated analogue to digital converter (ADC) that converts the analogue input signal to digital data. This data is transferred to the CPU for processing by the GDU system. Each module also contains a precision instrumentation amplifier with 11 programmable gain ranges (x1 to x1024).

After amplification any transducer signal offset can be optionally removed by the on-board voltage generator, and the resulting signal digitised.

The GDU input module covers a wide range of transducer types. Full details are given in sections 3 and 4. The following is a brief description of the facilities available.

The range provides for the connections of differential and single ended voltage sources, with sensitivities ranging from +/-5V full scale to +/-10mV full scale. A 10V supply is available for those sensors requiring excitation such as pressure transducers and LVDT's.

### 1.5.3 Physical Specification

| Specifications | Details |
|---|---|
| Dimensions (W x D x H) | 365 x 320 x 160mm (14.4" x 12.62 x 6.3") |
| Weight | 6.4kg (14.3lb) |
| Enclosure | Aluminium die-cast, powder coated |
| Display | None |
| Protections Class | I, IP20 |
| Pollution degree/installation category | 2; II |
| Power requirements | 110-115/230VAC ±10%, 50/60Hz, 115VA, single phase |
| Operating Environment | Temperature: 0 to 40°C(32 to 104°F)<br>Humidity: 10 to 90%, non-condensing<br>Altitude: to 2000m (6590ft) |
| Storage Environment | Temperature: -40 to 70°C(-40 to 158°F)<br>Humidity: 10 to 90%, non-condensing |
| Memory | 4Mb |
| Connections | RS232, Ethernet, DIN |
| Fuses | 2.5A, T, 250VAC |

### 1.5.4 Replacement Parts

| ⚠ *WARNING* | |
|---|---|
|  | Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer. |
| ⚠ *AVERTISSEMENT* | |
|  | Risque de blessures corporelles. L'utilisation de pièces non approuvées comporte un risque de blessure, d'endommagement de l'appareil ou de panne d'équipement. Les pièces de rechange de cette section sont approuvées par le fabricant. |

The user replaceable parts include the AC inlet fuses, analogue input modules, detachable power cord and CPU module.

See Maintenance section for details on fuse replacement.

Replacement/additional Analogue Input modules have the part number 1914B0046 or 27-1505.

Replacement CPU modules have the part number 1914B0065.

Replacement North American detachable power cord part number 8608-0012 (US office) or 6099X0229 (UK office).

## 2 INSTALLATION AND CONNECTION

| ⚠ *WARNING* | |
|---|---|
|  | Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document. |
| ⚠ *AVERTISSEMENT* | |
|  | Dangers multiples. Seul le personnel qualifié doit effectuer les tâches détaillées dans cette section du document. |

### 2.1 Inspection

Before shipping, the GDU was fully tested and any additional input modules that were ordered with the unit will have been fitted. Carefully check that all modules are in place and that there are no signs of damage.

### 2.2 Pre-Installation Checks

CAUTION
Before connecting power to the GDU, check that the voltage selection switch is correctly set, the plug-in modules are correctly inserted and their retaining screws are tightened.

Avant de brancher l'alimentation à la GDU, vérifiez que le sélecteur de tension est correctement réglé, les plug-in modules sont correctement insérés et leurs vis de fixation sont serrées.

### 2.3 Installing Additional Input Modules

The basic GDU consists of the chassis with a CPU with RS232 and Ethernet interfaces.

For systems with one analogue input module, this is inserted in slot 1 as default.

Shock hazard, modules must not be plugged in or removed whilst the system power is on.

Risque de choc électrique, les modules ne doit pas être branché ou retiré, tandis que la puissance du système est en marche.

If additional modules are ordered with the GDU chassis, these will be fitted and tested so that no installation will be necessary. When input modules are removed or supplied separately, the installation details are given in the data sheet located in section 3.3.

### 2.4 Power Connections

The power connections for your GDU depend which model GDU you have.

If your GDU is designed to operate on 230V then you will have been supplied with a fully moulded cable set fitted. A UK and EU approved cable set is provided. If the GDU is designed to operate on 115V then a US style moulded cable set is supplied.

No other lead is supplied to connect the GDU to any of the alternative input power supplies supported by GDU.

***NOTICE***

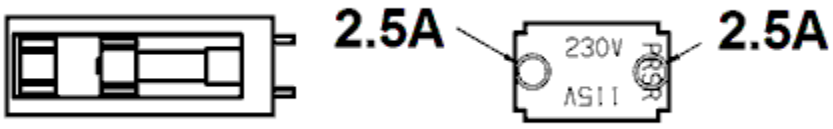
The GDU must be operated from a clean power supply or UPS (uninterrupted power supply) or you may incur power down errors.

***NOTICE***

Position the equipment so it is not difficult to operate the disconnection device.

Placez l'équipement de sorte qu'il n'est pas difficile de faire fonctionner le dispositif de déconnexion.

The GDU has two anti-surge (T) fuses that that are used to protect the unit in the case of over-current conditions. There are two fuses. For fuse replacement, reference the Maintenance and Specifications section and use only UL/CSA certified parts in the positions shown below.




## 2.5 Construction

### 2.5.1 Dimensions

The GDU physical dimensions are as follows:

| | |
|---|---|
| Height | 3U (160mm) |
| Width | 365 mm |
| Depth | 320 mm |

### 2.5.2 Mainframe Chassis

The mainframe chassis is of a modular construction that will enable you to upgrade your GDU to satisfy further demands you may place on the unit. The backplane PCB has 5 DIN 41612 type C sockets for easy module insertion.

There are 4 slots of which you may insert up to 4 analogue input module cards (slots 1 through to 4) dependent on the tasks you require the GDU to perform.

### 2.5.3 Internal Power Supply

The internal power supply provides all the necessary voltages to drive all the modules that may be fitted.

### 2.5.4 Rear Panel

Situated on the rear panel you will find the power on switch/filter that provides AC input for the unit. This is fitted with 2.5A anti-surge fuses.

The rear panel also has the output connectors to your computer, a 9 D-type connector plug for RS232 communication and an RJ45 connector for Ethernet comms.

A USB connector which may be used for future firmware updates is also on the rear panel.

## 2.6 Computer Communications Interfaces

The GDU is currently pplied with an RS232 interface for communication with the host computer. The interface connector is located on the rear panel of the GDU. The connection is a 9 way D fixed plug for the RS232 interface. A separate Ethernet connection is available which may be used as an alternative to the RS232 link.

Before connecting the GDU to the computer system it is recommended that the following precautions be observed:

- ❖ All peripheral devices should be turned off
- ❖ Plug each peripheral and the host into the mains supply
- ❖ All devices must have their grounds connected to the mains earth.

## 2.7 Configuring the RS232 Interface

The RS232 interface does not need configuring as it has a fixed baud rate/protocol. The host computer must be able to support the following configuration.

### 2.7.1 Baud Rates and Word Formats

The rate at which devices can communicate is specified by a “Baud rate” or the number of BITS/second. It is important that both transmitting and receiving devices operate at the same rate. Data is transmitted as a burst of pulses comprising an initial START BIT, followed by a number of BITS that constitutes a word.

Baud rate is 9600, Word size is 8 BITS with no PARITY check, and finally 1 STOP BIT.

### 2.7.2 XON/XOFF Protocol

This legacy mode where the host has no “listen” or input buffer for temporarily storing data, eg. Apple or Hewlett Packard microcomputers, is not supported.

### 2.7.3 RS232 Interface Connections

The standard 9 way ‘D’ RS232 interface connector is located on the GDU rear panel and has the following pin connections:

| Pin | Signal |
|---|---|
| 1 | Protective Earth |
| 2 | TxD (from GDU) |
| 3 | RxD (to GDU) |
| 4 | Not connected |
| 5 | Signal 0v |
| 6 | Not connected |
| 7 | Not connected |
| 8 | Not connected |
| 9 | Not connected |

*Table 1 RS232 Interface Connections*

The GDU uses a form of software handshaking to control the data interchange between it and the host computer and therefore does not use the interface handshake lines. RTS and DTR are not driven by GDU. Before connecting to the host computer consult the computer's manual for details of its RS232 interface connections and what handshake lines (if any) are used. Only three connections between the GDU and the computer are necessary, TxD, RxD and Signal 0V. Take care to ensure that the data transmitter at the computer end is connected to the data receiver at the GDU end and vice versa.

## 2.8 Configuring the Ethernet Interface

The Ethernet interface may be used as an alternative to the RS232 link. Connection to a host PC must be made via an appropriate router supporting 10BaseT.

The default device name of the GDU can be set via switch S1 on the CPU module 1914B0065. Switch S1-5 must be OFF. Depending on the nature of the network system, it may take some time for the GDU's register name to be recognised.

| S1-1 | S1-2 | S1-3 | S1-4 | GDU Name |
|---|---|---|---|---|
| Off | Off | Off | Off | ELE-GDU00 |
| On | Off | Off | Off | ELE-GDU01 |
| Off | On | Off | Off | ELE-GDU02 |
| On | On | Off | Off | ELE-GDU03 |
| Off | Off | On | Off | ELE-GDU04 |
| On | Off | On | Off | ELE-GDU05 |
| Off | On | On | Off | ELE-GDU06 |
| On | On | On | Off | ELE-GDU07 |
| Off | Off | Off | On | ELE-GDU08 |
| On | Off | Off | On | ELE-GDU09 |
| Off | On | Off | On | ELE-GDU10 |
| On | On | Off | On | ELE-GDU11 |
| Off | Off | On | On | ELE-GDU12 |
| On | Off | On | On | ELE-GDU13 |
| Off | On | On | On | ELE-GDU14 |
| On | On | On | On | ELE-GDU15 |

If the use of the registered name fails due to the network set-up then it may be necessary to configure the IP address manually.

The GDU can be set to a static IP address by setting switch S1-5 to On. By using the RS232 port a command is sent to configure the IP address. Refer to section 2.7 on the RS232 comms protocol.

The command format is :-

IPCFG <IP address> <gateway address> <subnet mask>

For example IPCFG 192.168.1.10 192.168.1.254 255.255.255.0

If the IPCFG command is sent with no parameters, the unit responds with the current IP configuration. This command may be used to confirm what IP address has been assigned to the unit.

## 2.9 Switching On

The memory in the GDU is non-volatile and data is retained in the case of a power outage. The system also has circuitry to detect a power failure.

On power up the system checks the power status and the integrity of any test data in the memory. Both the blue POWER and red PWR FAIL indicators on the front panel of the CPU module will be lit. If the memory check fails the red ERROR indicator will also be on.

Unless there is a problem with the CPU the GDU should always power up on with the PWR FAIL indicator on. Failure to do so may indicate that the data or firmware has been corrupted.

## 2.10 Power Failure Recovery

The GDU's data storage memory is retained in the absence of a mains supply. The retention period for this memory is in excess of 5 years.

If the mains supply voltage drops below 200 VAC (or approximately 100 VAC in 110 VAC regions) the processor is liable to go into random states. However, special memory protection is triggered if the supply drops below this level. If the supply continues to fall the memory and RTC power are protected. When the mains power returns to normal, the protection circuit waits momentarily for the power supplies to stabilize and then allows the processor to start operating. If the memory fails on power up the GDU indicates this with the ERROR LED.

Some test types may be able to continue in the event of a short power outage. The PWR FAIL indicator is used as direct indication that a power-failure has occurred. This is important if the GDU is to be left unattended for long periods of time, when this indicator can act as "tell-tale". On power up the GDU will be in the idle state and no more tests can be started, data may only be retrieved if it is not corrupt. At the users discretion some test types may continue although the test result cannot be guaranteed to be accurate.

New tests should not be commenced until the PWR FAIL indicator has been cleared. This is a protection feature as it forces the user to recall all previous readings into the host microcomputer before continuing. After this, the GDU can be reset with the RESET command to correctly initialise memory and all the GDU's internal systems.

NOTE: if turning the GDU off and back on again does not cause the POWER Indicator to come on then there may be a fault with the CPU, the internal or external power supply or a blown fuse.

# 3 ANALOGUE INPUT MODULE WITH TRANSDUCER EXCITATION

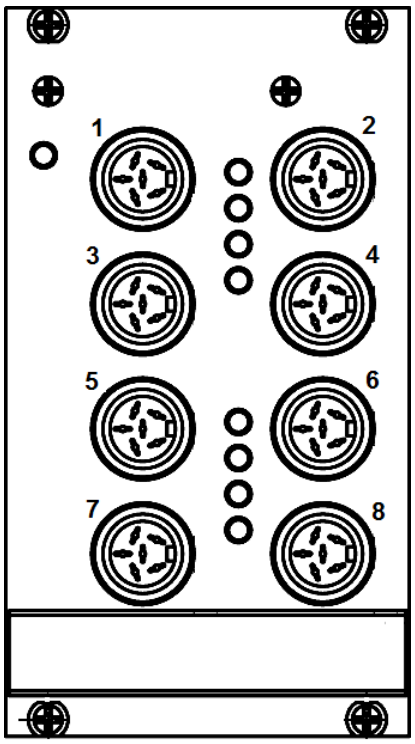
## 3.1 General Description

The Analogue Input Module is a general purpose input scanner capable of accepting up to 8 separate signal sources.

It has the part number 1914B0046 or 27-1505.

The input signals can range from +/-10 volts full scale when used with a system gain of 1, to +/-9.76 m.volts full scale when used with a system gain of 1024. The input channels are connected to the system analogue to digital conversion module by an 8 channel 2 pole solid state multiplexer.

The module features a 10 volt stabilised power supply for transducer excitation, thus simplifying the tasks of connecting many types of sensor, and has input overvoltage protection to prevent system damage in the event of incorrect connections being made.




The module has built-in gain, offset circuitry and a 16 bit ADC. On the front of the module are 9 status LEDs.

The top left LED indicates the module has been correctly recognised by the CPU. The other vertical 8 LEDs down the centre of the module indicate the channel selection status. These LEDs are on when a particular channel has been 'SET'.

The top LED is for channel 1, going down to the channel 8 LED at the bottom.

## 3.2 Specification

| | |
|---|---|
| Number of input channels | 8 Differential |
| Signal Range | +/-10 Volts Full Scale (x1 system gain) to<br>+/-9.76mV Full Scale (x1024 system gain) |
| Cross Talk Immunity @ DC | 120 dB |
| Cross Talk Immunity @ 10 kHz | 80 dB |
| Leakage Current | 10 nA |
| Transducer Supply | 10 Volts +/-10 mV |
| Stability | 50 ppm/$^{o}$C |
| Maximum current per module | 500 mA |
| Maximum Input Voltage | ± 14 Volts |

## 3.3 Installation

Before installing the input module in the mainframe the 2 address switches (S1) on the card must be set so that the module's input channels correspond to those required. In the following table the switches are numbered 1 and 2. The channels are set in blocks of 8.

| S1-1 | S1-2 | Ch. Range |
|---|---|---|
| DOWN | DOWN | 1 to 8 |
| UP | DOWN | 9 to 16 |
| DOWN | UP | 17 to 24 |
| UP | UP | 25 to 32 |

*Table 2 Module Address Selection*

Having set the channel range, turn off the system power and insert the module into the required I/O slot. The module can be plugged into any of the 4 I/O slots regardless of the channel range selected but it is recommended that the left-most slot is used for channels 1 to 8, the next slot for channels 9 to 16 and so on. Care must be taken not to set up different modules with the same channel range.

## 3.4 Signal Input Configurations

Signals within the input module are switched to the input of a programmable gain instrumentation amplifier. This amplifier will accept differential signals within a ± 14 volt range of the system common (Signal 0V). For single ended inputs connect Signal 0V to the –ve signal input. Ideally, this should be done at the signal source. If this is not possible then make the link on the input module connector.

| Pin | Signal |
|---|---|
| 1 | -ve Channel Input |
| 2 | +ve Channel Input |
| 3 | Signal 0V |
| 4 | -5V Supply |
| 5 | +5V Supply |

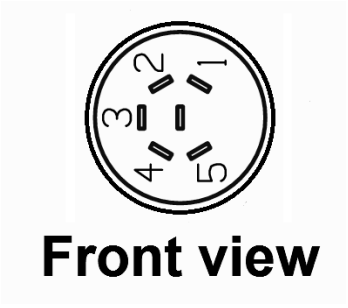
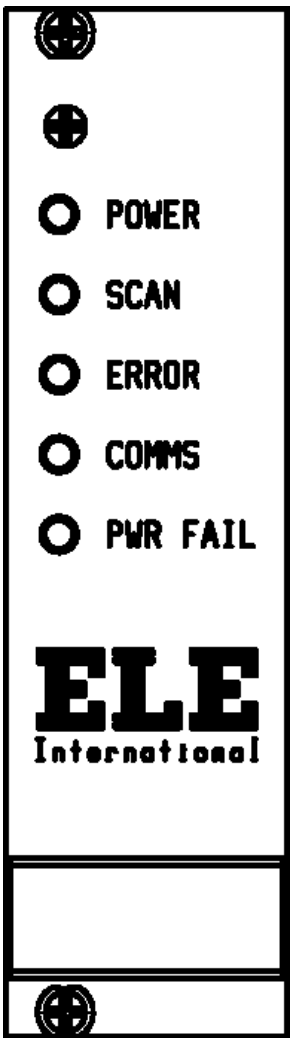



*Table 3 5 Way Din Connectors and Screw Terminal Connections*

# 4 CPU MODULE

## 4.1 General Description

The GDU CPU consists of a microprocessor, non-volatile memory, Micro SD card and various interfaces.




There are five status LEDs that indicate the current condition of the CPU.

POWER : blue LED indicating that the 5V power is active.

SCAN : a green LED indicating the ADC cards are being sampled.

ERROR : a red LED indicating error conditions, see below.

COMMS : green LED indicating comms traffic between the GDU and host PC.

PWR FAIL : a red LED indicating a power fail has occurred since the last system RESET.

Error LED

Flashes if there is no valid program in the SD card or program space. Stays on for invalid data in the non-volatile memory. Is on if there is an invalid comms message, then cleared when the host PC sends an ERROR message.

## 4.2 Switch Settings and Jumper

There are two eight bank DIP switches (S1 and S2) on the GDU CPU.

Switch S1 is used for test mode and Ethernet setup (where applicable, see section 2.8).

Switch S2 is reserved for development use.

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## 4.3 Firmware Updates

The CPU contains a flash memory device that holds the firmware for the GDU. This device will appear as a memory device when connected to a PC via the USB connection on the rear panel. The green COMMS LED on the CPU front panel should be on continuously when this occurs. The firmware can then be updated by copying (over-writing) the latest GDU_BOOT.BIN file to the memory device. Once this has been done, do not eject the device, instead remove the USB cable. The SCAN, ERROR, COMMS and PWR FAIL LEDs should then flash as the programming sequence completes. If updating is successful the ERROR LED will be off.

# 5 MAINTENANCE

| DANGER |
| --- |
|  Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document. |
| **DANGER** |
|  Dangers multiples. Seul le personnel qualifié doit effectuer les tâches détaillées dans cette section du document. |

| NOTICE |
| --- |
| Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired contact the manufacturer. |
| **AVIS** |
| Ne pas démonter l'appareil pour la maintenance. Si les composants internes doivent être nettoyés ou réparés contacter le fabricant. |

### Clean the instrument

Clean the exterior of the instrument with a moist clothe and a mild soap solution.

### Replace the instrument's fuse

| DANGER |
| --- |
|  Fire hazard. Use the same type and current rating to replace fuses. |
| **DANGER** |
|  Risque d'incendie. Remplacez les fusibles par des fusibles de même type et de même calibre. |

Fuse failure is typically caused by an instrument problem. If the fuse continues to fail, contact Customer Service.

Refer to Specifications for fuse requirements.

1. Set the power switch for the instrument to off.
2. Remove the power cord for the instrument from the electrical outlet.
3. Use a flat-blade screwdriver to open the fuse drawer.
4. Remove the fuse drawer and replace the fuse.
5. Install the fuse drawer.