



EnCompass 3G

Wireless Data Collector (Standalone)



Data and Instruction Manual

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1. Introduction

1.1 - Copyright, Limitation of Liability and Revision Rights

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1.2 - Symbols



Indicates something to be noted by the user



Indicates important information



Indicates high voltage

1.3 - Conventions for Cautions and Warnings

CAUTION



Cautions advise the user to proceed with care. They alert users to situations wherein there is potential that they might perform an action which could result in an unexpected outcome or the loss of data which could be permanent. Cautions contain an explanation of why the action is potentially problematic.

WARNING!



Warnings advise the user to proceed with *extreme* care. They alert users to situations wherein there is potential that they might perform an action which could result in personal injury or damage to equipment. Warnings contain an explanation of why the action is potentially dangerous.

1.4 – Risk Avoidance

To avoid the risk of personal injury and damage to equipment the **EnCompass** must be operated in accordance with the guidelines and specifications detailed in this manual, as well as all statutory requirements and regulations. Take special heed to all Cautions and Warnings. Refer to Section 3 for Safety information and Section 8.2 for I/O limitations.

2. Introduction to the EnCompass

2.1 – Device Overview

The **EnCompass** is the world's first wireless performance monitor. Covering every type of input with tremendous functionality, this data collector is the all-encompassing solution for wireless sensor and power monitoring. The easy-to-deploy **EnCompass** can capture data from *any* sensor *and* power source, convey it securely and reliably to the web where you can instantly see it, or connect it effortlessly to any destination you choose; a seamless stream of innovation taking data to its full potential.

An astonishing array of applications awaits the **EnCompass**, from agricultural applications such as grain temperature monitoring or greenhouse humidity monitoring, and ecological applications such as soil sampling and flow metering, to industrial applications including power metering, pressure monitoring, voltage optimisation and load shedding. However, with both power *and* sensor inputs in one low-cost device, the performance of plant, equipment, machinery and systems (PEMS) can be seen like never before. With performance data, profound opportunities can be unearthed, using Condition-Based Maintenance to prevent costs and, by comparing actual performance with its potential, discovering significant savings.

Using a smart integrated system, the **EnCompass** provides a simple and easy-to-interpret interface between complex systems and the user. It provides many options and advanced features which offer state-of-the-art monitoring of building services or industrial processes. The varied I/O configurations and universal connectivity enable the device to be customized for each user's requirements.

2.2 – Features

- Data transferred over 3G/GPRS or TCP/IP
- Powered by 5v USB mains adapter or 24v PSU.
- 21 inputs including serial, digital and analogue and 1 digital output. See Sections 2.3 and 2.4.
- Serial connection to enable constant, high resolution reading of all data.
- Spring loaded terminals giving increased connection reliability and security.
- Simple setup and clear configuration, either locally or remotely via the device/data management hub installed onboard.
- Data can be reviewed on local dashboards
- Local or remote (www) configuration options.
- Sampling and reporting fully customizable.
- CE approved
- IP67 rated



2.3 - Monitoring Capabilities

- **Power Meter** - 3 voltage connections and 1 neutral plus 4 current inputs allow for the termination of electrical supplies and current transformers (CT's) that can monitor the electrical consumption of entire buildings or individual items of plant.
- **Non-Invasive Metering** - If only the electrical current is monitored via the CT's, an assumed constant voltage, or a local (same distribution transformer supply) common reference voltage can be used to calculate power (using continuous current sampling, if the node is sufficiently powered). The reference voltage can be obtained from any standard wall-plug on the same distribution. This facility provides accurate power monitoring without having to make 230V connections at each remote meter point.
- **Pulsed Output** - The triac digital output can be configured to send a 100ms active pulse on every kWh consumed for sending electricity consumption data live to any existing Building Energy Management System (BEMS).
- **Temperature Monitoring** - Five temperature inputs enable many thermistor-type sensors to be connected and monitored. This can be useful for efficiency monitoring of process and building Heating, Ventilation and Air Conditioning systems (HVAC). Again the use of temperature monitoring can be vital in determining the state and condition of specific equipment. These can also be configured as digital inputs (See Digital Status below).
- **Digital Status and Logger** - Two/seven (see above) digital inputs provide utility and/or maintenance data. Each can be configured to count pulses, regularly sample the status, or log the exact time of each change of status.
- **Humidity and Environmental Monitoring** - One humidity and three 4-20mA connections provide the application of any process or environmental transducer to allow analysis of specialist conditional monitoring. The 4-20mA inputs can be configured to interpret data from many kinds of sensor, including temperature, humidity, pressure, light, vibration and fluid dynamics.
- **Serial Connection** - The serial connection enables constant, high resolution reading of data from all inputs, using an attached computer.

2.4 – Inputs and Outputs



WARNING!



Some of the inputs may be connected to hazardous voltages.
Disconnect the power before working on this equipment.



Input wiring must be installed in accordance with national and local regulations/requirements.
All wiring types must be selected appropriately, according to their function and operating constraints.

The inputs for the **EnCompass** require glands or conduit entries in the gland plate at the bottom of the **EnCompass**. Care needs to be taken to ensure the IP rating remains intact. See Electrical Installation methods in Section 7. Each input can take a wide range of readily available sensor types. All inputs and outputs are protected against electrostatic discharge (ESD).

2.4.1 - Connection Details

The connections to the **EnCompass** are via cable entry holes in the bottom of the case, where cables pass through glands and terminate into the spring loaded plug-in terminals mounted on the edge of the printed circuit board. The case has a detachable plate that is screwed, complete with seal. This plate can be replaced with a blank or with 4 or 8 holes. The cover over the terminal compartment is screwed complete with seal.

2.5 - Power

2.5.1 – Using a 24v PSU or 5v USB Mains Power Adapter

The **EnCompass** 3G can be powered by 230V mains power. This can be provided by a 24vdc PSU, 5vdc USB power adapter or by a direct connection to a computer's USB port. This option allows for continuous power consumption calculations to take place when just the current is attached.

2.5.2 - Drawing Power from Voltage Input V1

When Voltage Input V1 is being measured, the power going through this input will be used for the CPU, enabling continuous power consumption measurement. This will mean the power adapter will only be used to power the transceiver.

The voltage threshold required on Voltage Input V1 for this to occur is between 45-230V AC.

3. Safety

3.1 – Important Safety Information



Be sure to heed the following warnings to prevent personal injury or damage to equipment.

WARNING!



The voltage range of the V1, V2, V3 & N terminals are rated at 240/415v AC and are dangerous if connected to the mains. Incorrect installation may cause death, serious personal injury or damage to the equipment. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must always be complied with.

WARNING!



The circuit powering the **EnCompass** is 3.6v (battery), 5-24vdc or 5v (USB mains adapter), depending on the power module being used. Disconnect power before installation or servicing to prevent electrical shock or damage to equipment. Make all connections in accordance with national and local electrical codes. Use copper conductors only. To reduce the risk of fire or electrical shock, install in a controlled environment relatively free of contaminants. The **EnCompass** is only intended for use as a monitoring device. To prevent loss of data or damage to equipment, **DO NOT USE IT FOR ANY OTHER PURPOSE.**



Static charges produce voltages high enough to damage electronic components. The microprocessors and associated circuitry within an **EnCompass** device are sensitive to static discharge.

Follow these precautions when installing, servicing, or operating the system:

- Work in a static-free area.
- Discharge any static electricity you may have accumulated.
- Discharge static electricity by touching a known, securely grounded object.
- Do not handle the printed circuit board (PCB) without proper protection against static discharge.
- Use a wrist strap when handling PCBs. The wrist strap clamp must be secured to earth ground.

WARNING!



All electrical installation work must be undertaken by a suitably qualified and competent person and must be carried out in full accordance with all relevant Statutory Requirements and Regulations.

3.2 – Before Commencing Repair Work

WARNING!



1. Disconnect/Isolate the mains 220/250v supply, if connected.
2. Ensure that all safety and operational measures have been implemented.

3.3 – 3-Phase Power

WARNING!



The metering capability of the **EnCompass** means that it could potentially have 3 phase power connected. Extreme care must be taken when the existence of 300-415vac is present.

4. Deploying the EnCompass

4.1 - Before Deploying the EnCompass



Read this guide before installing. If the EnCompass is installed incorrectly, Utilivista's guarantee obligations will no longer apply. If in doubt, contact us.

The EnCompass must be mounted in a suitable environment in a position that allows safe access and good clearance for wiring, servicing, removal and connection of all the I/O.



Environmental Considerations

- Do not operate outside the ambient temperature range (-20°C to +60°C).
- Do not cover. Allow air circulation.
- Protect from direct contact with steam or any other harmful substances.



Where possible keep away from the following:

- Steel poles, pipes, RSJ's, cladding and other large metal surfaces.
- Electric motors or high frequency drives.
- Other strong wireless signalling systems, dishes or antenna's.
- High voltage electric cables or transmission lines.
- Any equipment that transmits high levels of interference (high EMC / RF).
- Areas where there is the potential for mechanical damage or obvious obstruction to normal operational behaviour.



To maximise signal strength:

- Mount the EnCompass in its upright position (though it can be mounted in any orientation).
- Fix the EnCompass as high as practically possible.

4.2 - Fixing the EnCompass

The EnCompass should be fixed to a wall or other permanent structure by attaching a screw or bolt to the building or equipment framework, and hanging the node via the keyhole fixing on the back of the unit. Allow 300mm between the EnCompass and any other fixed equipment or services that may cause mechanical / electrical damage or interference.



Take care not to drill materials that may be harmful. Also ensure that there are no hidden services etc. in or near the path of the drill.

To avoid any danger in fixing as described above, alternative fixings could be used such as cable strap, Velcro, "No-Nails" or similar.

4.3 - Connecting Cables



All cables and wiring must comply with national and local regulations and standards.

It may be more convenient to make all the connections before mounting the device, especially if it needs to be positioned at a higher level to gain good reception. In this case ensure long enough tails are provided to enable tidy clipping/fastening to the building fabric/cable tray.

Remove the front access cover and route the cables through the gland plate and connect to the appropriate terminals.

The installer must ensure that the cable glands or entry system is sealed to IP67 standard to maintain the IP protection category. If these necessary steps are not taken and an **EnCompass** is damaged because of ingress of water or other particulates and corrosive vapours, Utilivista will not be obliged to replace the unit within the warranty period.



Ensure all cable entries are used or plugged with the appropriate gland/plug.

See Section 7 – Electrical Installation, P24, for more details.

5. Configuring the EnCompass

5.1 – Accessing the Device

Connect the **EnCompass** to power via the 24v PSU or the USB adaptor.



The settings for IP networking can be changed, but the **EnCompass** must first be accessed using its default IP address: **192.168.1.130**.

To add to a LAN which allows a new device with static IP address 192.168.1.130:

- Connect the RJ45 Ethernet cable into a switch or router.
- You may need to wait for about 2 minutes for the device to be fully booted up and available via Ethernet cable. See the following Section 5.3 for a guide to the LED indicator showing the Ethernet port status.

To connect directly to a computer (e.g. to change the IP address to suit your LAN):

- Ensure your computer is not connected to any other LAN, either wirelessly or through an Ethernet cable.
- Connect the RJ45 Ethernet cable into your computer's Ethernet port. You may need wait for about 2 minutes for the device to be fully booted up and available via Ethernet cable. See the following Section 5.3 for a guide to the LED indicator showing the Ethernet port status.
- In the TCP / IP settings of the LAN connection for your computer, set the IP address manually within the range **192.168.1.1 – 192.168.1.254**, (but DO NOT use 192.168.1.130), and the subnet mask to **255.255.255.0**.
- Open Internet Explorer or another browser on a computer on the network, and type into the address bar: **http://192.168.1.130**.

5.2 – Logging In



You will need to log in with a username and password.

The username must be 'admin', 'manager' or 'user':

- Logging in as 'admin' allows you to change any settings.
 - The default password for admin is: C2iAdmin
- Logging in as 'manager' allows you to change configuration settings but not general settings.
 - The default password for manager is: C2iManager
- Logging in as 'user' means that no changes can be made.
 - The default password for user is: C2iUser

Passwords can be changed in the *Administration* settings. Each login type allows all settings to be viewed.

CAUTION



It is strongly advised to create a unique password at the earliest opportunity. This document, and thus the default passwords, are publicly available.

5.3 – Using the LED Indicator

When powered, the LED on your **EnCompass** will indicate the status of the device with a series of flashes followed by a five second gap. The number of these flashes between each pause indicate the following:

	Device is Functioning	Ethernet Networking is Functioning	3G is Functioning
No Flashes	X	X	X
1 Flash*		X	X
2 Flashes			X
3 Flashes		X	
4 Flashes			

* When networking needs to be initiated (e.g. on inserting an Ethernet cable) this may continue for about two minutes.

5.4 – Settings and Tools

5.4.1 – Administration

To access these settings, open the *Settings* folder in the menu and then click *Administration*. You will see options for the following:

- *Label and Description for Device:* You can set values for these, for display purposes.
- *Location Info:* These settings describe the site on which the device is installed. If applicable, they synchronise with the online SiteConnect interface, with the following rule: The latest edit, whether on the device or online, takes precedence and overwrites previous values in both places, except for the customer name setting, which is always retrieved, if possible, from SiteConnect.
- *Update password:* This is the only field which can be edited by the non-admin usernames, and gives the opportunity to change the password for the username you are logged in as. If logged in as admin you can also set any of the usernames to revert back to their default password.
- *Internet Activity and Time Synchronisation:* The time will be kept accurate by regular synchronisation over the internet or with a local timeserver which you can specify here. If you need to be able to set the time manually then set *Only use NTP to set time* to **No**. This will not disable synchronisation but will allow you to click an icon on the front page next to the time and change it manually. To access the front page at any time, (where the current time is displayed) click the *Front Page* icon at the top right of the screen.
- *Internet Activity and Remote Access / Updates:* If the device is to be continuously online (which is not necessary for all functionality), you can choose to automatically apply updates (*Check for Updates*), and to allow remote access through SiteConnect (must be purchased).
- *User-Initiated Updates:* If you have an update from C2i that needs to be manually uploaded, e.g. because the device is not connected to the internet, you can use the *Drop .upg file or click to upload* section of the page. You will see a message that the file is uploaded, and the update will then be applied.

- *System Boots*: This shows the latest boot timestamp, which will be based on the time settings at the time of booting up. There is a link to *Reboot now* which will perform a reboot; the device will be off for up to one minute, and network connectivity may take more than a minute to be restored. There is also a link to *Restart modules* which power cycles all peripheral modules including the modem.
- *Configuration Backup Files*: A configuration file contains all settings relating to the pages in the menu under 'Configuration', though no data history. Configuration files can be downloaded or uploaded and applied on the Administration page. All firmware versions to date use the same format for these files (version 1).

5.4.2 – System Info

To access these settings, open the *Settings* folder in the menu and then click *System Info*. As well as seeing version information and technical information for the device, you will see options for the following:

- *Locale Settings*: Time zone can set, with all the geographic options from any continent, or the option of always using Greenwich Mean Time. There are also settings for date format and the choice between temperature in °C or °F.

5.4.3 - Network Settings

To access these settings, open the *Settings* folder in the menu and then click *Network*.

- *IP Network*: Use these settings if you need to assign an IP address, subnet mask or default gateway (if using a gateway to the internet or to another network). Alternatively, you can specify that DHCP addressing should be used by your router to allocate the **EnCompass** 's IP address, in which case you will need to find out the IP address from your router to be able to access the **EnCompass**.
- *Mobile Network*: For setting the APN, username and password specific to the SIM card inserted for mobile internet. This information can be provided by the mobile internet company. This section also shows connection status, remote IP address, boot-time signal strength, and mobile network.

5.4.4 - TCP / UDP Ports

To use this page, open the *Settings* folder in the menu and then click *TCP / UDP Port Numbers*. It shows port numbers for all incoming and outgoing connections, with options to turn off activity on specific ports.

5.4.5 - Settings for Digital Inputs (applicable only to devices with digital inputs installed.)

These settings are located by opening the *Configuration* folder and then the *Onboard Inputs* folder in the menu.

There is a page called *Generic Settings* which allows you to set the sampling interval for both digital inputs. (The interval between any two consecutive data values, between 10 seconds and 4 hours.)

The page called *Status / Pulse* allows you to activate and set the mode for the digital inputs. The options for mode are: *Take regular snapshots* or *Keep pulse count*.

5.5 - Settings for **EnCompass** Inputs & Outputs

These settings are located by opening the *Configuration* folder and then the *Onboard Inputs* folder in the menu. There is a page called *Generic Settings* which allows you to set the sampling interval for all inputs. (The interval between any two consecutive data values for any input, between 10 seconds and 4 hours.)

There are also pages for each type of input as described below.

5.5.1 - Labels for all inputs

All the inputs can optionally be given a label with maximum length of 17 characters, which is used for display purposes on these pages and is also used as a column heading in CSV files. (See Section 6.4 - CSV Files and Reporting Schedules)

5.5.2 - Voltage

Set the mode to **Enabled** to activate voltage inputs. Also on these devices, there is the option to calculate *Maximum*, *Minimum*, and *Average Values* which will mean that for each timestamp in the data log not only is there a value for the average voltage between that point in time and the next timestamp (i.e. normal sampling on the **EnCompass** 3G), but also a value for maximum and minimum voltage.

5.5.3 - Current

Set the mode to **Enabled** to activate current inputs. A current input needs to be assigned a CT sensor, so that the value can be given in terms of Amps. Enter the manufacturer first, then the sensor category, then the sensor label. If the sensor is not available it needs to be added to the library and calibrated for use on an **EnCompass** (See Section 5.8 - Adding Sensors for **EnCompass** Inputs).

If the sensor is changed for an activated input, and then the page saved, an option will appear asking if the change should be backdated to historical data or only apply from that point in time. See the consumption section for more information on setting up current inputs in relation to consumption calculations in kWh.

5.5.4 - Thermistor

Set the mode to **Enabled** to activate thermistor inputs. A thermistor input needs to be assigned a sensor, so that the value can be given in terms of your chosen temperature unit (see the general settings for the **EnCompass**: *Administration Settings*). Enter the manufacturer first, then the sensor category, then the sensor label here. If the sensor is not available it needs to be added to the library (See Section 5.6 - Adding Sensors for **EnCompass** Inputs).



If the sensor is changed for an activated input, and then the page saved, an option will appear asking if the change should be backdated to historical data or only apply from that point in time.

5.5.5 - Status / Pulse

Any digital input to be used needs to be assigned a mode:

- **Record All Changes** – This will ignore the sampling interval and give data values whenever the input changes between **On** and **Off**.
- **Take Regular Snapshots** – The state of the input will be recorded, using the sampling interval of the **EnCompass**.
- **Keep Pulse Count** – A running total will be recorded, using the sampling interval of the **EnCompass**. A unit can be specified, which will be appended when data is displayed. A conversion factor can be entered, such that the number of pulses multiplied by this factor is equal to the number of specified units. If the conversion factor is changed for an activated input, and then the page saved, an option will appear asking if the change should be backdated to historical data or only apply from that point in time. Once the conversion factor has been entered, the value (in specified units) can be overridden to a user entered value, relevant to a specified time (which must be a time near the actual time of entering it in these settings) so that the value will be synchronised with another counter.



If the unit is powered by mains power any of the thermistor inputs can be used as digital inputs, giving you up to five additional inputs for status / pulse. The mode of these inputs can be altered on this page.

5.5.6 - 4-20mA

A 4-20mA input needs to be activated here if it will be used, by setting the mode to **Sampling**, then when physically connected to a powered 4-20mA, sensor data will be sampled. A 4-20mA input needs to be assigned a sensor, so that the value can be given in the appropriate unit. First the manufacturer, then the sensor category, then the sensor label must be entered here. If the sensor is not available it needs to be added to the library (See Section 5.5 - Adding Sensors for **EnCompass** Inputs).

5.5.7 - Digital Output

This can be switched **On** or **Off** here.

5.5.8 - Troubleshooting: Input Not Active

If there is no recent data for an input that you expect to see data for, check the following things:

1. Physical connection: For 4-20mA inputs, there will be no data sent unless the input is properly connected.
2. Enabled in software: The input must be enabled in the page for that input type (see above sections).
3. Re-enable: If the above has been checked, there is a slim possibility that a problem happened when enabling the input or in the case of consumption data, setting the current transformer. If this is the case, changing this setting, then saving, then changing back to the desired setting, will in all probability rectify that problem.

5.6 - Adding Sensors for **EnCompass** Inputs

In the *Configuration* folder of the menu there are folders for *Current Transformers*, *4-20mA sensors*, and *Thermistor sensors*. Opening any of these folders reveals a tree of manufacturers, then sensor categories (see below), then specific sensors.



Using any sensor that is not in this library requires adding it using these pages.

At the bottom of the list of manufacturers in the menu there is a page called *New Manufacturer*, which you should use if you are adding a sensor of an unlisted manufacturer.

At the bottom of the list of specific sensors for any category, there is a page called *New Sensor* which you should use for adding the sensor. See the sections below for what information is required on this page.

5.6.1 - Current Transformers

The only category of current transformers is 333mV CTs. A new CT needs to be calibrated for use on an **EnCompass**. To calibrate:

1. Set the conversion factor to 1.
2. Save the sensor and go to the page for current inputs (see Section 5.5.3) and select the newly added sensor for the appropriate input.
3. Have the CT connected to the input, with a known current on the circuit.



Please note that the manual for the CT may specify that the CT is not accurate below a certain current. The current you measure should exceed that threshold.

4. Note the time at which the known current is being measured.
5. When a value is available for that known time, calculate the conversion factor as follows: actual current (amps) / value read on the device (amps) = conversion factor.
6. Return to the page for the new Current Transformer, using the tree in the menu as described in this section; then update the conversion factor.
7. **Save.**

5.6.2 - 4-20mA Sensors

The categories are: *Temperature*, *Humidity*, *Pressure*, *Flow*, *Level*, *Air Quality* and *Other*.

A new sensor needs the following information entered: unit, and two values in terms of the specified unit, one for when the sensor outputs 4mA and the other for 20mA.

5.6.3 - Thermistor Sensors

The categories are: *10K Sensors*, *20K Sensors*, *PT100 Sensors*, *PT1000 Sensors*, and *Other*.

A new sensor needs the following information entered: Temperatures (in your chosen temperature unit, see Section 5.4.2) and resistances (ohms) for any 3 calibration points.

Changes will be automatically applied within 60 seconds.

5.7 - Diagnostics

5.7.1 – Error Log

- *Reports*: You will be able to see details of any problems with email or FTP operations, which may be due to an intermittent internet connection, incorrect server details, etc.
- *Modbus*: You will be able to see details of any problems with Modbus requests, which may be due to registers not being valid on a particular device, or failure to connect to the device. The presence of an error message indicates that a read request was attempted.

5.7.2 - Upgrade Log

To access the *Upgrade Log*, open the *Diagnostics* folder from the menu and click on *Upgrade Log*.

This shows all upgrade activity for this node. A table shows the date and time, upgrade filename and status of all upgrades, most recent first.

To manually initiate upgrade, if you have a file for this, see Section 5.4.1. Please note that it may take up to 2 minutes for an uploaded upgrade file to show in the *Upgrade Log*.

5.7.3 - Boot Log & GSM Log

This shows all instances of the device shutting down or booting up, as well as all instances of the GSM connection status changing.

5.7.4 - System Power Log

This gives information about changes to powering mode (Mains or UPS), and hourly values for processor voltage and UPS battery voltage.

5.7.5 - Ping Tool

To access the *Ping Tool* open the *Diagnostics* folder from the menu and click on *Ping Tool*.

This allows you to ping IP addresses or domain names on the local area network or the internet and see responses.

6. Viewing and Exporting Data

6.1 – Summary of Interfaces for Monitoring/Export

6.1.1 – Graphics and Tables on Web Pages

Use your web browser to see dashboards and tables for latest data, and tables and graphs for historical data.

6.1.2 - CSV Files and Reporting Schedules

Comma Separated Variable (CSV) files can be requested for any combination of device and input type. These can be downloaded on request or scheduled for email and / or FTP upload at user definable regular intervals.

6.1.3 - Modbus Slave Functionality

Applicable only to devices with Modbus additional functionality.

If the device is set up as a Modbus TCP/IP Slave, any input for which data is being received can be assigned a register number so that the latest value can be read via Modbus at any time.

6.2 - Dashboards

To see a dashboard page for all C2i inputs, click on the serial number or name of this device, at the bottom of the left-hand menu.

The dashboard screen is split up into sections allocated to different input types. All inputs that are active will show in the appropriate section. If you see fewer inputs than you expect.

Each input is labelled either with a generic name, e.g. 4-20mA Input 1, or the customised name if you have given a label to the input (see Section 5.4, P11).

Clicking on the dial or displayed value for an input allows you to see more historical data and graphs for that input (see Section 6.3.2).

The dashboard screen refreshes automatically when new data comes in for the inputs.

6.2.1 - Voltage and Current

7 dial graphics show the latest voltage and current for phase 1, 2, and 3 and the neutral current. A timestamp shows under the dial showing the exact time that this was sampled. Also displayed are the values of the minimum, average, and maximum voltage and current for the hour leading up to that timestamp, and a trend graph showing sampled values in that last hour.

You can click on one of the dials to see more historical data and graphs for a specific input, or click on one of the hourly trend graphs to see more graphs for a voltage / current pair.

6.2.2 - Status / Pulse / kWh Consumption

Up to 9 sections of the screen show either counters or ON / OFF status values, for each of this type of input / output, with timestamps showing the exact time that this was sampled.

6.2.3 - Temperature and Humidity

Up to 7 sections show values for each input in these categories, with timestamps showing the exact time that this was sampled. Also for thermistor inputs a trend graph shows sampled values in the last hour leading up to that timestamp.

6.2.4 - 4-20mA Inputs

Up to 3 sections show values for each 4-20mA input, displayed as described above for thermistor inputs.

6.3 – Graphs and Tables

6.3.1 – For All Inputs

To see a table of the latest data from any inputs of any devices, open the *Diagnostics* folder from menu, then click *Data*.

Use the check boxes for device and input type and use the filter checkboxes to select which combination of devices and input types you are interested in, then click **Refresh Data**, for a static table or **Auto Refresh**, for a table which will be refreshed automatically every 30 seconds.

There will be a row in the table for every active input that matches your filter options. Each row shows the Device ID, Input ID, Input Name, the latest value and when it was captured.

For Modbus inputs, the Input ID means the absolute register address.

For C2i inputs, the input ID consists of one or two letters (input type) followed by a number (input number within that type, except that numbers are not used for SHT75 inputs), e.g. T1 for thermistor input 1. The input types are indicated as follows:

V = Voltage
I = Current
C = Consumption
T = Thermistor
D = Status / Pulse
A = 4-20mA
ST = SHT75 temperature
SH = SHT75 humidity

Also on each row is an expand link which allows you to see more historical data and graphs for that input (see following Section 6.3.2).

There is also a checkbox which you can select and then use the **Delete** button at the bottom of the table, if you wish to delete all stored data for that input.

6.3.2 - Historical Data

See above section(s) for how to access graphs and tables of historical data for a specific input. These pages have the following options for changing which data is shown:

- **Date:** The default setting is today's date, or latest date for which there is data.
- **Data Range:** The default setting is **24 hours** which shows 24 hours of data ending with the last known value for that date. The other options for this are:
 - 2 weeks ending on this date
 - 7 days ending on this date
 - 24 hours
 - 4 hours (beginning either at 0:00, 04:00, 08:00, 12:00, 16:00 or 20:00).

For the first two of these options, because of the larger amount of data, just a graph is shown with no accompanying table.

The graphs and tables show all the known data in the specified range; the frequency of data is determined by the settings for the input in question.

6.4 - CSV Files and Reporting Schedules

6.4.1 - Description of the CSV files

The **EnCompass** provides data files in the Comma Separated Variable (CSV) file format. These can be opened in a variety of applications, including spreadsheet programs such as Microsoft Excel, and also imported into many monitoring software offerings. An example of the first 3 lines of text from a CSV file for 2 different inputs is shown below:

```
Timestamp,Mod-meter 40001 K-counter,Node A211410-0136 V1 Ref-voltage,  
27/03/2015 00:00:00,237001,242.4,  
27/03/2015 00:05:00,237008,241.9,
```

The column names for an input (text on the top line, after the first column of 'Timestamp', are composed of the following information, appended together:

- If a C2i input:
 1. The label of the Modbus device or C2i device, or the serial number if there is no label (see Section 5.4, P11).
 2. A code showing which input this is on the device. E.g. V1 for input input 1, I1 for current input 1, T1 for temperature input 1, D1 for digital input 1, A1 for 4-20mA input 1, ST for SHT75 temperature, SH for SHT75 humidity.)
 3. The label of this input, if it has been labelled.
- If a Modbus input (*applicable only to devices with Modbus additional functionality*):
 1. The label of the Modbus device.
 2. The register address, e.g. 40001
 3. The label for this register address, if it has been labelled.

The first column of all rows of data is a timestamp, showing the date (in your chosen date format) and the time (HH:MM:SS).

Data in the columns after this is written as numbers (without any characters separating thousands), with the number of decimal places used being dependent on 1) the type of field this is measuring, if a C2i input, or 2) the specified number of decimal places for that register, if a Modbus input.

There will be one row in the CSV file for each timestamp for which data was sampled for any of the inputs that the CSV file is for. The CSV file will only apply to a specific range e.g. the latest 24 hours.

6.4.2 - Downloading a one-off CSV file

To download a CSV file:

1. Open the *Diagnostics* folder from the menu then click *Data*.
2. Use the check boxes for device and input type to select which combination of devices and input types you are interested in.
3. Click the **CSV Download** link below the checkboxes.
4. Select a start date and (inclusive) end date.
5. Use either the **Download CSV File** link or the **No Timeout Download** link. The first of these will take no longer than a few minutes but if you have requested lots of data (e.g. 100,000 values in total) the file may be incomplete. (In this case the filename will indicate that it is incomplete). The second of these can take an unlimited length of time and will always give a complete file with all the data you are requesting.

If your browser shows a security bar asking you to confirm download of the file, click to **Confirm**. You may then have to do the previous step again.

6.4.3 - Description of scheduled CSV reports

A report can be scheduled so that data relating to a user defined combination of devices and input types is emailed and / or uploaded via FTP, at a defined frequency.

The input types you can select from are:

- C2i Inputs:
 - Voltage** (If applicable you can select just Max, Min or Average. See Section 5.5.2, P13).
 - Current**
 - Temperature**
 - Status / Pulse**
 - 4-20 mA**
- Modbus Inputs (can be combined in the same report):
 - Discrete Coils**
 - Discrete Inputs**
 - Holding Registers**
 - Input Registers**

The frequencies you can select are:

5, 10, 15, or 30 minutes

1, 6, 12 or 24 hours

Weekly (with options for when the week starts), or monthly.

The scheduler will perform the following actions:



The description refers to the scheduler sometimes having to continue to check whether a report can be sent. If enough time elapses such that more reports of this definition would be ready to send, then it groups all the necessary reports as one longer one rather than sending multiple reports at the same time.

1. Wait until it is time for another report. (e.g. for 15 minute reports, wait until a little before 0, 15, 30, or 45 minutes past the hour. The report may be ready a little before these times, for example if the sampling interval for this data was 1 minute, the report for 12:00-12:15 would contain data for times up to 12:14, because the data for 12:15 would be included in the next report.)
2. Check that all the data for this report has been received by this device.
3. Build the CSV file, naming it as defined by the user, with a suffix in the filename to show the times it relates to, and check that it can be emailed to the specified address(es) and / or uploaded to the specified FTP server. If it can then do so. If it cannot due to problems with the internet connection, keep checking until the internet connection is OK.

6.4.4 - Scheduling CSV file reports

To schedule a report, open the *Configuration* folder and then the *CSV Reports* folder, then click **New**. Use the check boxes for device and input type to select which combination of devices and input types you are interested in. Then enter values for the following fields:



You can run an instant test of the settings once they are saved.

- *Report ID*: An ID to use to refer to these particular settings for automatic reporting.
- *Frequency*: See section above.
- *Filename*: Maximum 28 characters. It will be appended with the date and .csv file extension. As well as alphanumeric characters, you can use the underscore and dash characters.

Email Settings (If email is to be used):

- *Email to*: An email address, or more than one, separated with commas.
- *Email From*: An email address to appear as the sender address. To reduce risk of emails being put in a spam folder the domain name of this address should be that of your SMTP server (see below).
- *Email Subject*: Enter a subject if you want emails to be sent with a subject line different from the csv filename.
- *SMTP Server*: Server name for SMPT (Simple Mail Transport Protocol). The device does not function as a mail sending server so you must use an external one which this device must be able to access.
- *SMTP Port*: This is usually 25.
- *SMTP Username and Password*: Enter these if your server requires authentication.
- *SSL Security Required*: Select yes if your SMTP server requires SSL (Secure Sockets Layer) security.

FTP / SFTP Settings (If FTP uploads are to be used):

- *Connection Type*: 'FTP in active mode' is the default. 'FTP in passive mode' means that all connections to the server are initiated by the client. Often the reason for using this mode is to prevent a firewall blocking the connections. 'SFTP' can also be selected which is a different protocol with added security, using Secure Shell (SSH)
- *Server*: IP address or server name e.g. ftp.example.com.
- *Port*: TCP Port for this server. Usually this is 21 for FTP or 22 for SFTP.
- *Username and Password*: For FTP authentication.
- *Folder*: A folder found in the root folder of the FTP server, e.g. reports, or the path to a subfolder, e.g. reports/workshop. The folder entered here must exist on the server. Leave blank if just uploading to root folder.

Once you have entered the necessary settings click **Save**.

6.4.5 - Altering, Duplicating or deleting an existing scheduled report

To see the settings for an existing scheduled report, open the *Configuration* folder and then the *CSV Reports* folder, then click the appropriate report ID. Any settings can be altered and the report saved again. If the Report ID is altered, this will duplicate these settings and create a new report. Use the delete icon to remove this scheduled report.

6.5 - Modbus Slave Functionality

Applicable only to devices with Modbus additional functionality.

If the device is set up as a Modbus TCP/IP Slave, any input for which data is being received can be assigned a register number so that the latest value can be read via Modbus at any time.

To access the page for the Modbus Server, open the *Configuration* folder and then the *Modbus Server Settings* folder, then click *Modbus Server Settings*.

The top section of this page gives options for the status of the Modbus Server (On/Off), and the TCP Port used for requests, which **cannot** be any of the following reserved ports:

20, 21, 25, 80, 102, 123, 5001, 32123, 34962, 34963, 32964

Once the status has been set to **On**, and the page saved for the first time, you are able to assign specific inputs to specific Modbus addresses. You can choose which addressing mode for registers, as follows:

Register Addresses (Absolute), in which the first input coil is displayed as 10001 and the first input register is displayed as 30001, or **Input Numbers Within Type**, in which the first input coil is displayed as 0 and the first input register is also displayed as 0.

To assign specific inputs to specific Modbus addresses, use the filter checkboxes to select the devices and input types you are interested in (see Section 6.4.1 - Description of the CSV Files for a list of input types), then click **Apply Filters**.

Then for each input that shows in the table you can set the following information:

- Input Register Type: The options are, **Input Register, 16 bit integer, Input Register, 32 bit float**, (these options are not available when assigning for a coil input being read from another Modbus RTU or Modbus TCP slave), or **Coil, Single bit 1/0**, (this option is available when assigning for a C2i digital input or a coil input being read from another Modbus RTU or Modbus TCP slave.)



If registers are assigned as 32 bit float input register, the byte order (strictly speaking, the word order or register order) is High -> Low.

- Modbus Address: This can be entered individually for each input, or if you wish to assign consecutive addresses to inputs in the table, enter the address for the first row in the table, and any others that will not simply take the next register address after the input above it in the table, then click on **Auto-Fill Empty Addresses**.

After saving any changes on this page, please allow a minute for these changes to take effect.

7. Electrical Installation

7.1 - Mains Input Wiring Instructions

WARNING!



The voltage range of the V1, V2, V3 & N terminals is rated at 45-230v AC so connecting to the mains can be dangerous. Incorrect installation may cause death, serious personal injury or damage to the equipment. Consequently, the instructions in this manual, national and local rules, as well as safety regulations, must all be complied with.



The voltage and neutral inputs are used solely for the measurement of power consumption and some power quality analysis. These inputs are rated at 230 volts although if connected to a three phase supply there may be upwards of 400-415v present. Connections must therefore only be carried out by a suitably qualified and competent person.

**THE MAINS SUPPLY MUST ALWAYS BE ISOLATED
BEFORE WORKING ON THIS EQUIPMENT.**



Fused protection must be incorporated when connecting the **EnCompass** to mains, with 250mA quick blow fuses.

The voltage range to enable consumption etc. is between 45-230Vac therefore the user can connect a voltage of 45Vac and still maintain a consumption reading. Please see the commissioning and configuration instructions for more details.

7.2 – CT Installation Instructions

These installation & application notes refer to 1-5A secondary CTs NOT 0.333vac CTs.



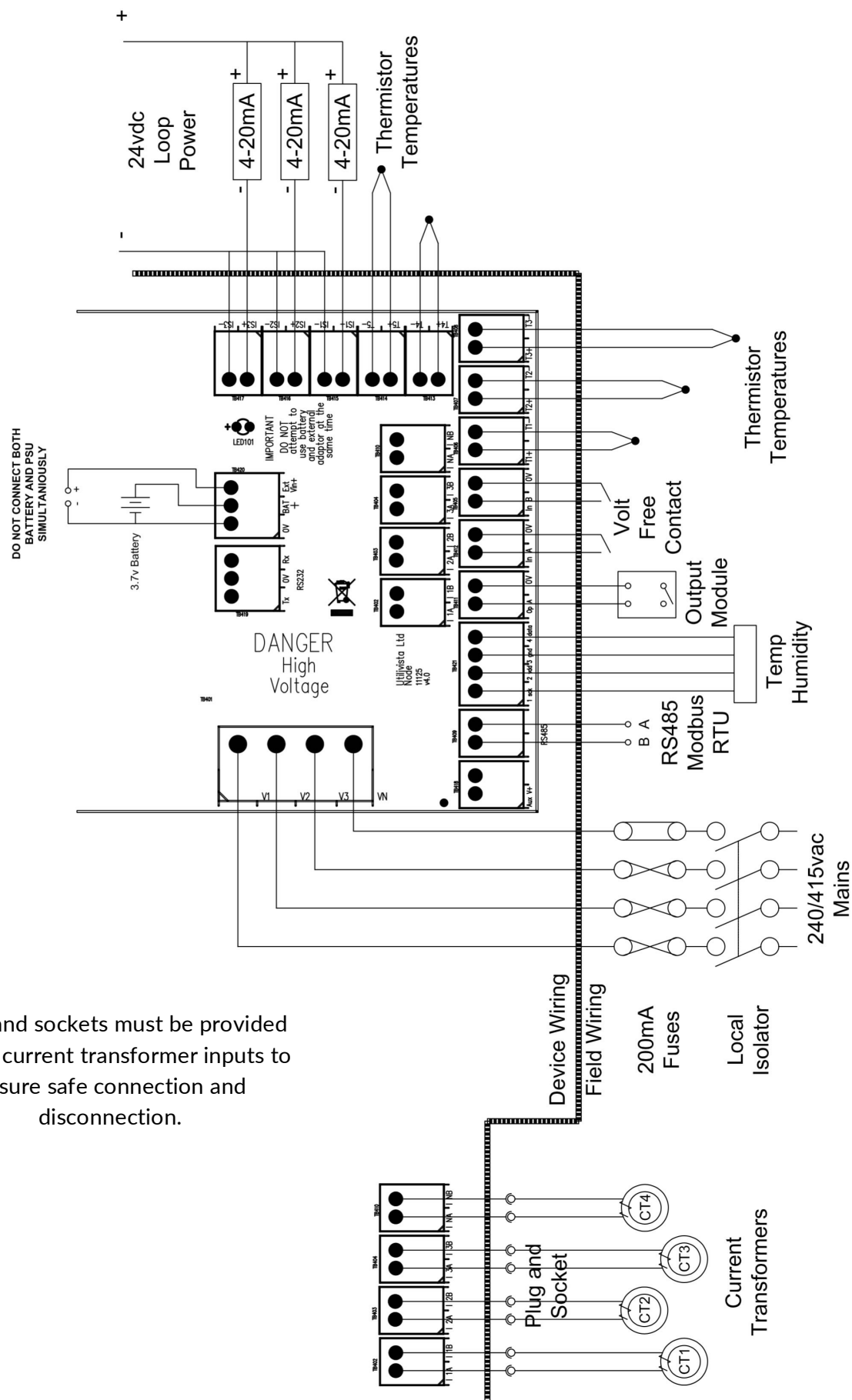
It is essential with certain instrumentation that the CT is physically orientated correctly on the conductor, or P1 must face the supply and L or P2 must face the load. It is also important to ensure that the secondary connections are made in accordance with the instrument connection diagram.



The secondary terminals of the CT must NOT make open circuit on load as dangerously high voltages may occur under these conditions. During installation the secondary terminals must be shorted and during operation it is recommended that one side of the secondary winding is earthed.

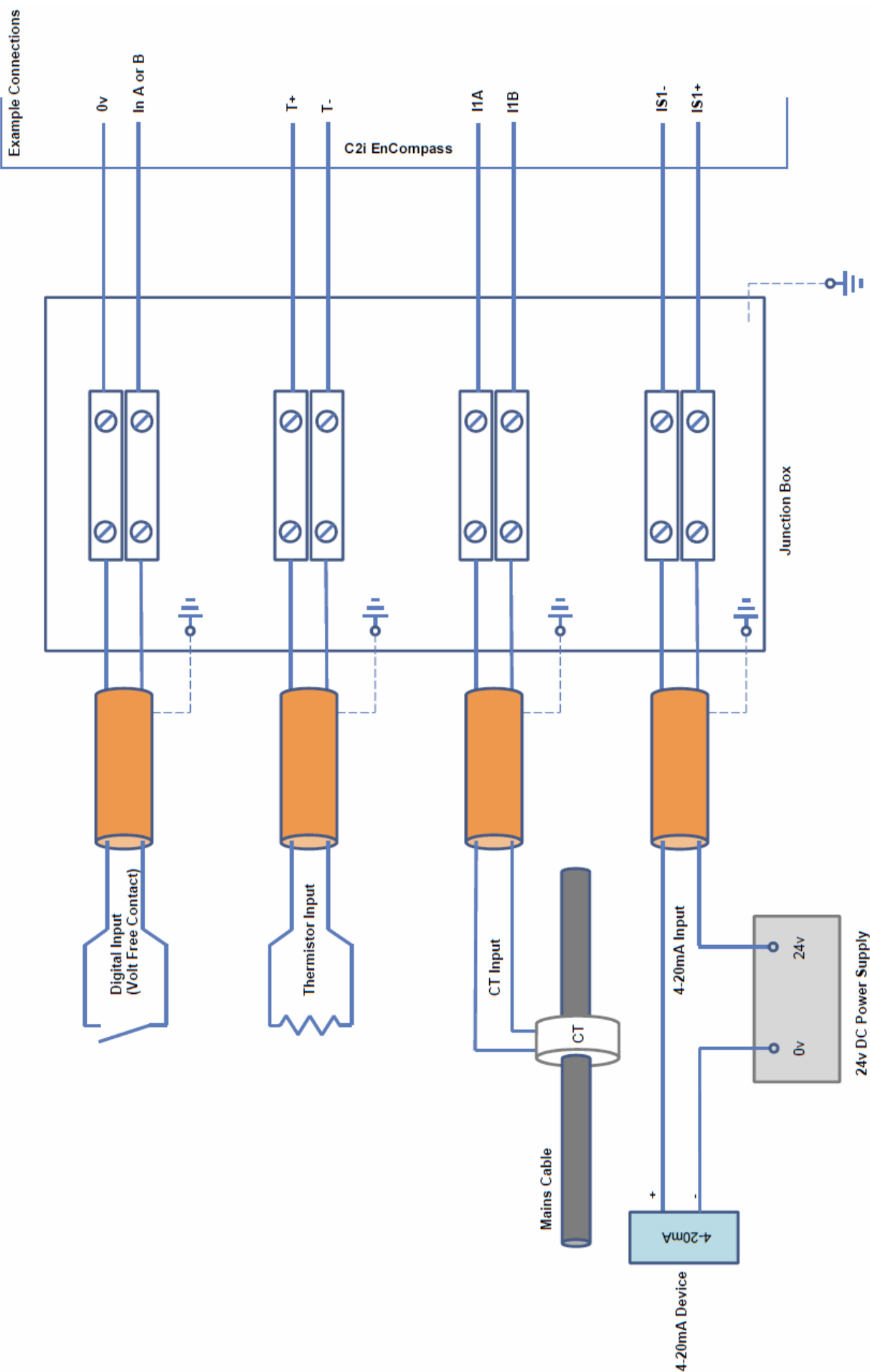
On all current transformers it is possible to reduce the CT ratio by passing multiple turns of the primary conductor cable through the aperture. The resultant CT ratio will be CT primary rating divided by the number of through turns e.g. a 100/5A CT with the primary conductor passed through the aperture twice will produce a CT with a ratio of 50/5A.

7.4 - Wiring Diagram

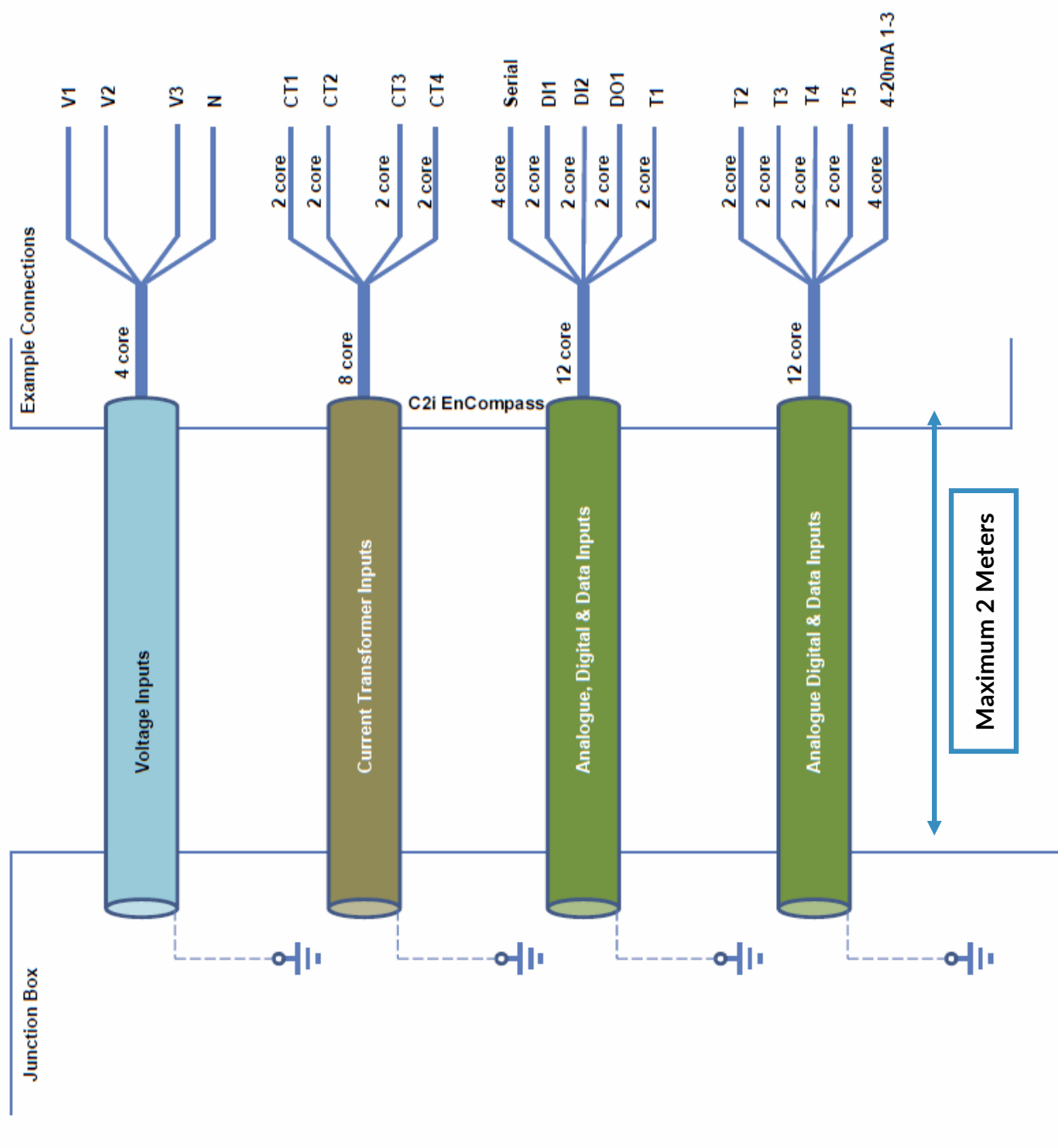


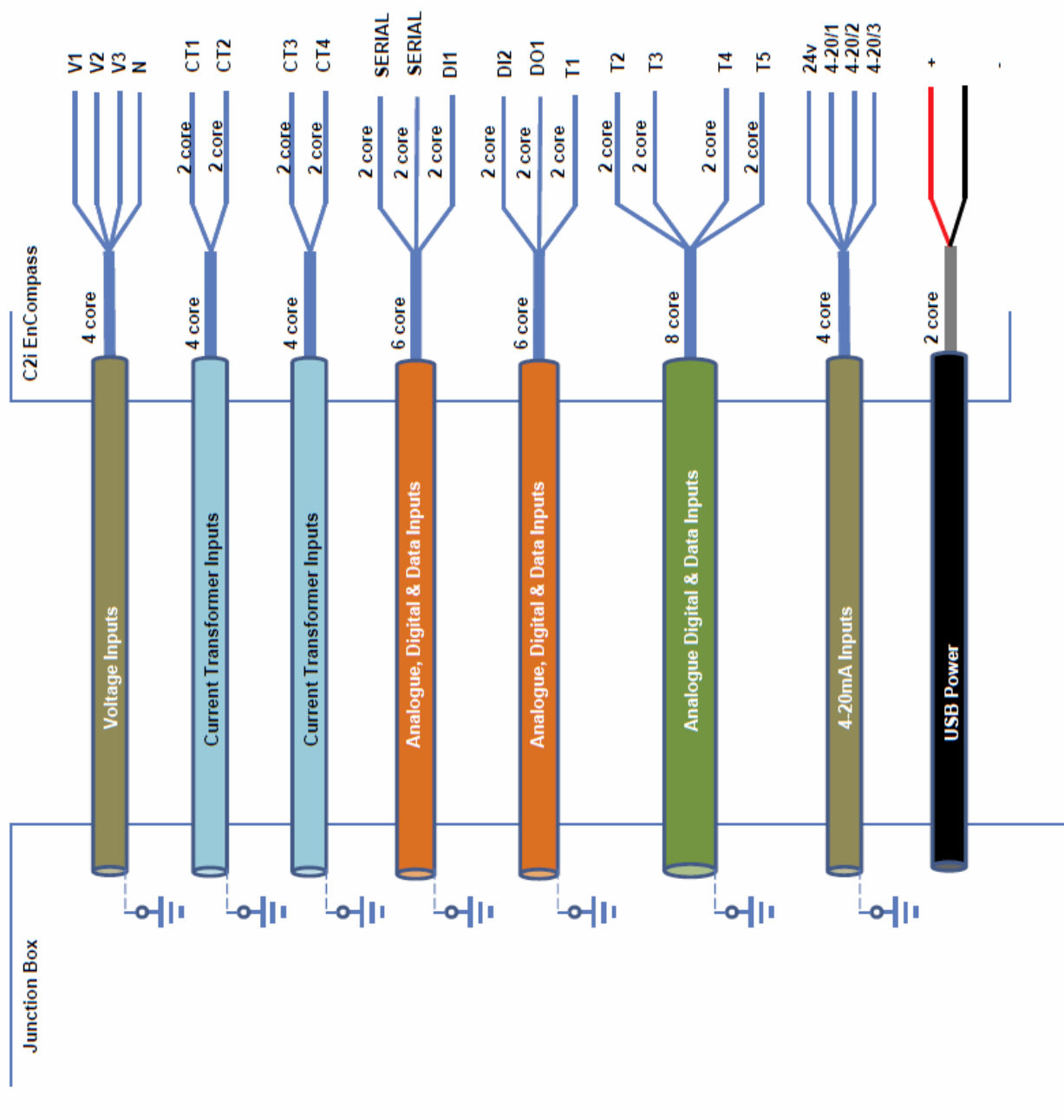
Plugs and sockets must be provided for the current transformer inputs to ensure safe connection and disconnection.

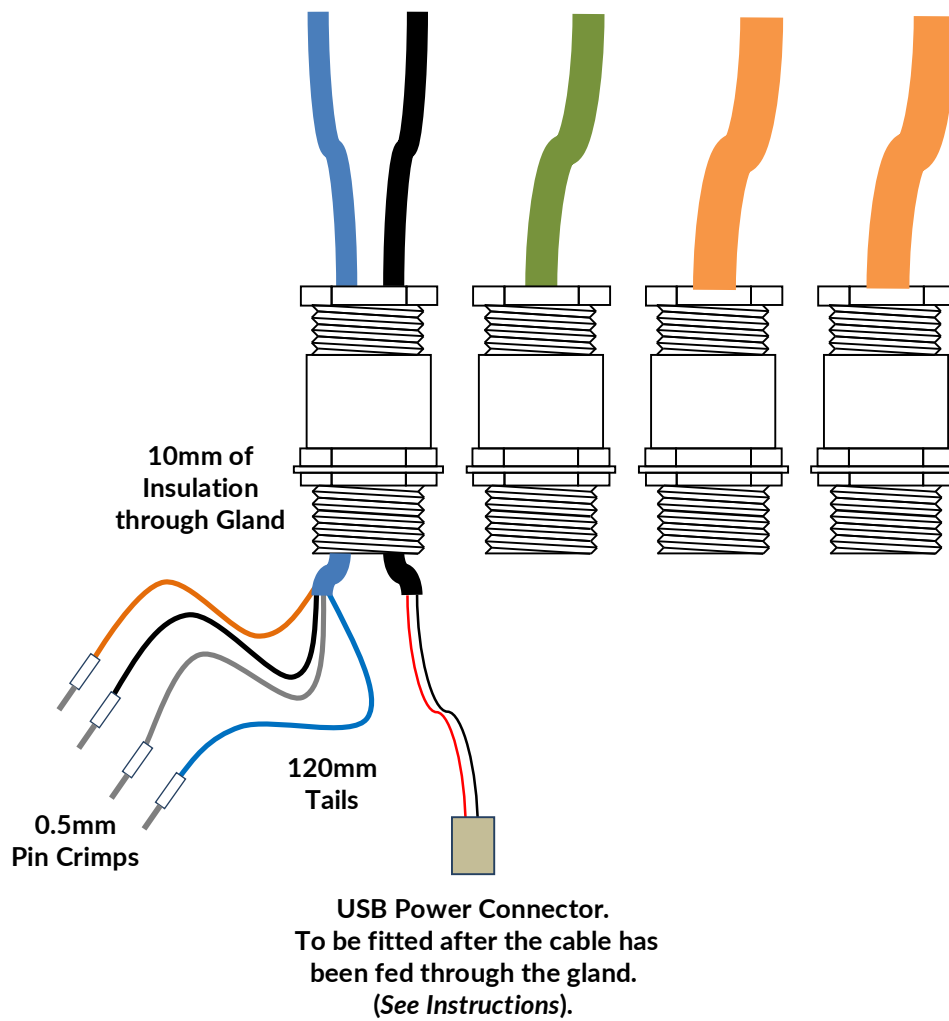
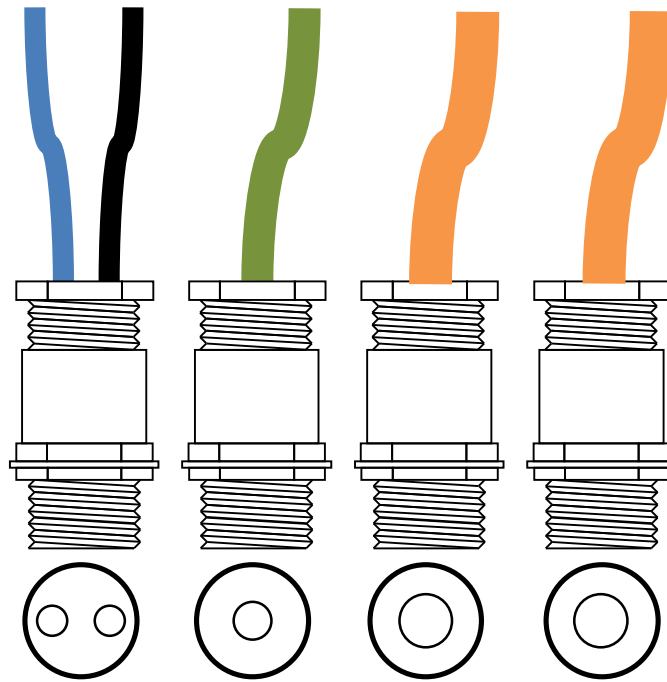
7.5 - I/O Connection Diagram



7.6 - Wiring Configurations

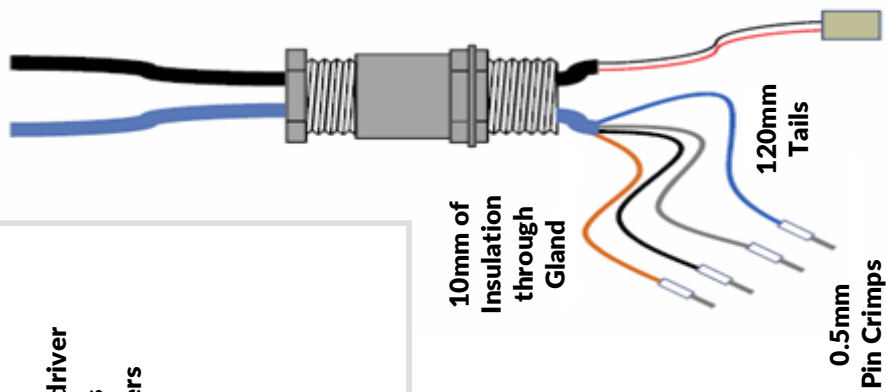






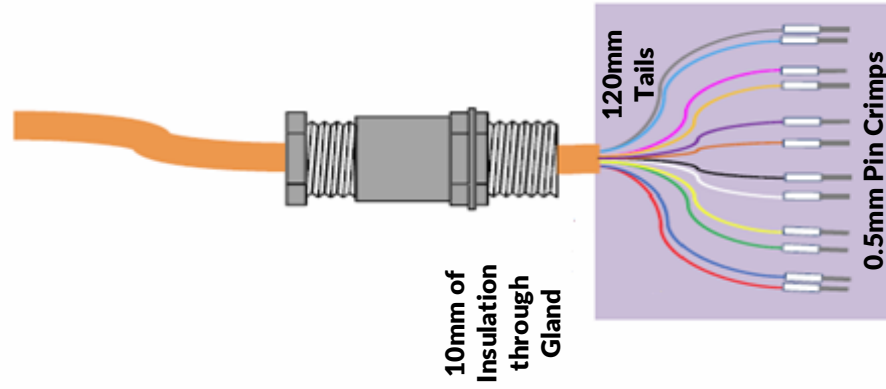
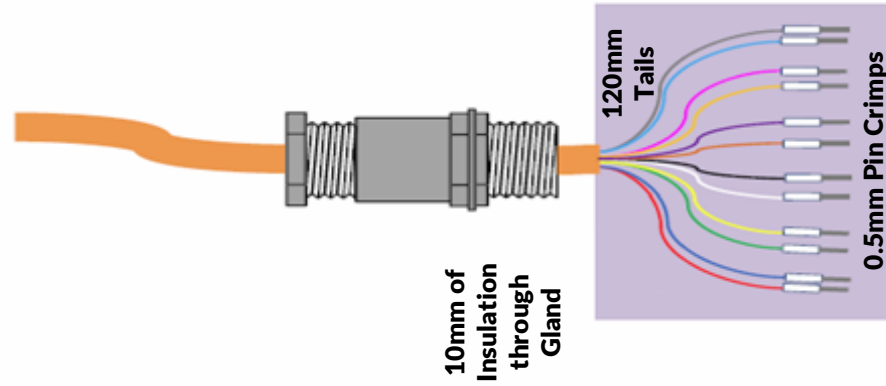
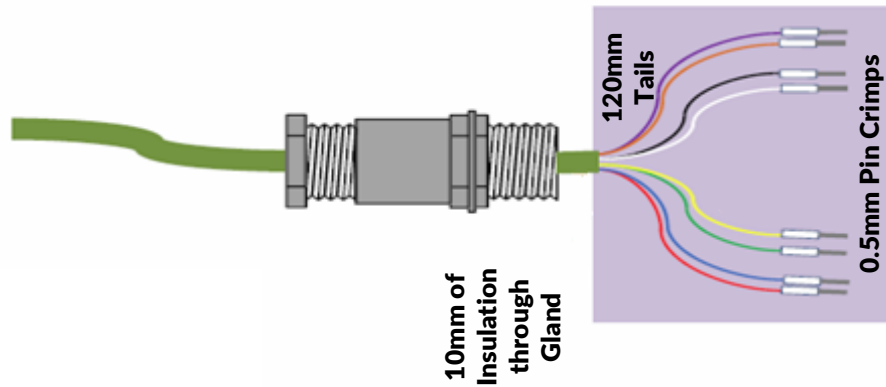
Recommended Tools (Excluding Fixing Method)

- Long Reach Socket & Wrench (10mm and 16mm Glands)
- M3 Allen Key
- Terminal Screwdriver
- Thin Nose Pliers
- Small Side Cutters
- Knife
- Cable Strippers
- Crimpers
- Testers
- Magnet
- Tape Measure

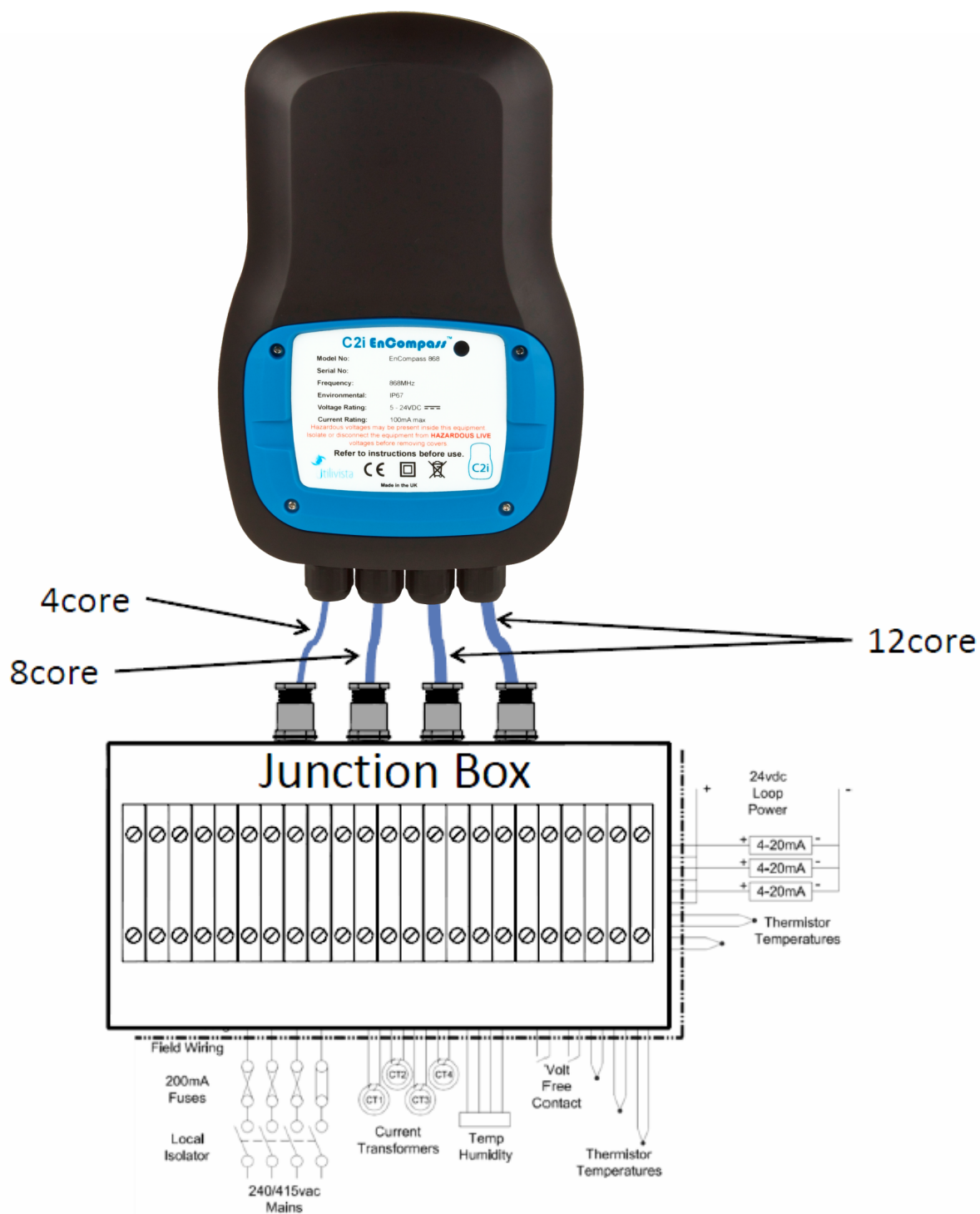


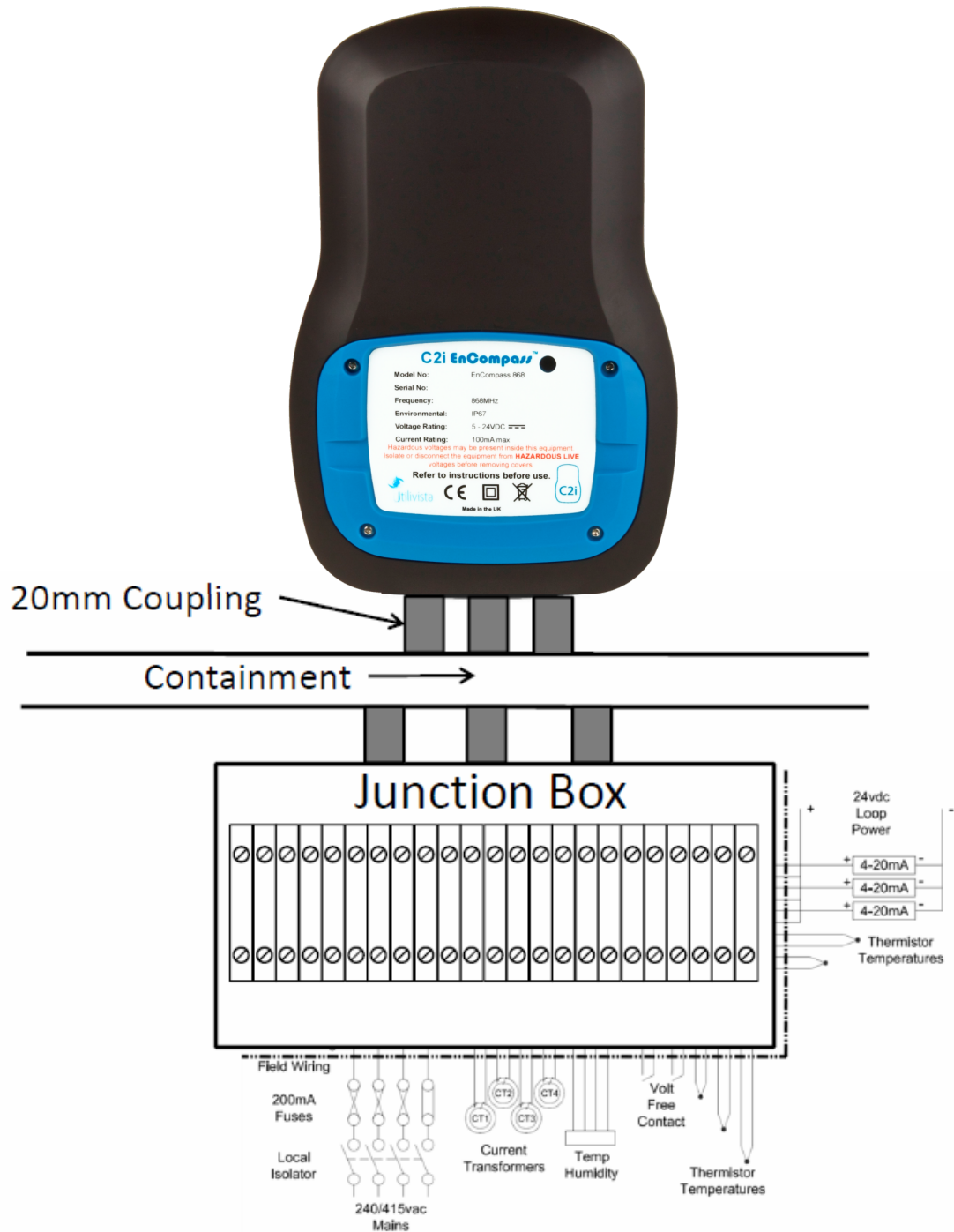
USB Power Connector.

To be fitted after the cable has been fed through the gland.
(See *Instructions*).



7.7 - Alternative Connection Methods





8. Specifications

8.1 – Power Specifications

Power Supply	USB/PSU (5/24vdc) mains adapter
Mains Input Voltage	Voltage 1-3 range 45vac – 230vac. 50/60Hz Isolated from other I/O
Wiring (Mains)	Cage-Clamp terminals rated at 630v 12Amp Suitable for cables 0.14mm ² to 2.5mm ²
Wiring (Other)	Cage Clamp terminals rated at 250v 2Amp Suitable for cables 0.5mm ² to 1.5mm ²
See Wiring Diagram on Page 25	
Current Consumption (Transmitting)	85mA
Current Consumption (Receiving)	20mA
Current Consumption (Sleep Mode)	250nA

8.2 – Inputs and Outputs

SUMMARY

Voltage Measurement	3 x Voltage Inputs rated @ 45 – 230 VAC
Neutral	1 x Neutral Input Rated @ 45 – 230 VAC
Current Measurement	4 x CT Inputs 0.333 v or 75 mA
Status or Pulsed Count	2 x Digital Inputs (Volt Free Contact) or 7 x Digital Inputs (if selected in place of Temp. inputs)
Status of Totaliser Output	1 x Digital Triac Output for Alarms or BMS Pulsed Meter Input
Temperature and Humidity	5 x 10K3A1 Thermistor Inputs (or 5 extra Digital inputs)
4-20mA	3 x 4-20 mA Inputs for various Transducers (Loop Powered)
Dual Input Interface	Used for Temp/RH Input
Serial	RS232 and RS485

AC VOLTAGE INPUTS

Voltage Rating	230 V AC
Min Operating Voltage	45V AC
Full scale max Voltage	380V AC
No-Load Loss (typical)	1.30W
Frequency	50/60Hz
Error	±1% Typical

CURRENT TRANSFORMER INPUTS

Voltage Rating Max	500mV AC
Secondary Current Rating Max	73mA
Frequency	50/60Hz
Load Resistor	6.8Ω
Error	±1% Typical

DIGITAL INPUTS

Voltage Rating	5V DC
Input Logic Low Voltage (typical)	<0.7V
Input Logic High Voltage (typical)	>2.25V
Input Type	Logic level
Operating Logic	Open circuit = 1, Closed circuit = 0
Pulsed Input	Fast Counter
Max	220ms

DIGITAL OUTPUT

Output Type	Open collector with 10K pull up to Aux-in terminal
Output Resistance	10 Ohm
Current Sink (max)	25mA

TEMP/HUMIDITY INPUT

Voltage Rating	3.3V
Available Current Rating	0.55mA
Operating Range (Temperature)	-40 to 123.8°C
Operating Range (Humidity)	0 to 100% RH
Error (Temperature)	±0.3°C
Error (Humidity)	±1.8%

THERMISTOR INPUTS

Operating Voltage	3.3V DC
Short Circuit Current (typical)	280uA
Input Type	Thermistor 10K, 20K
Operating Logic	Open circuit = 1, Closed circuit = 0
Pulsed Input	Fast Counter
Max	220ms
Error	± 0.1 °C when < 50 °C, dependant on sensor used

4-20mA INPUTS

Voltage when sensing (Max)	5V DC
Current Rating	20mA
Sense Resistor	240 Ω
8/12 bit Resolution	0.1mA/0.025mA (firmware dependant)

24V DC

Input Voltage (max)	36V
Input Voltage (min)	5V

8.3 – Casing Specification

Material	Acrylonitrile Butadiene Styrene (ABS)
Dimensions (H,W,D)	235.00 x 154.06 x 73.22 mm
Volume	3.5x10 ⁻¹⁶ Ωcm
Weight	1.1kg approx.
Colour	Black
IP Rating	67
Approvals	CE
Impact Strength	240J/m
Ultimate Tensile Strength @ 20°C	40Mpa
Elongation at Break @ 20°C	50%
Instantaneous Flexural Modulus @20°C	2200Mpa
Compressive Strength @ 20°C	42Mpa
Specific Gravity	1.05x10 ³ kg/m ³
Poisson's Ratio	0.35
Surface Resistance	< 10 ⁹ Ω
Vicat Softening Point	95
Coefficient of Thermal Expansion	10.1x10 ⁻⁵ m/m°C
Maximum Operating Temperature	60°C
Temperature Range	-20°C to +60°C
Thermal Conductivity	0.2W/m°C
Specific Heat	1.47kJ/kg°C
Thermal Ignition Resistance	HB @ 1.5mm

8.4 - Special Conditions

No testing has been carried out in any of the following environments:

- High altitudes.
- Pressurised cabins or containers.
- Explosive atmospheres.

8.5 - Approvals

- CE approvals on the node ensure safety measures are integrated successfully.
- IP67 protection, where 6 means total protection against dust and 7 means protection against immersion between 15cm and 1m of water for 30 minutes.
- Operating temperature range: -20 to +60 °C.



C2i only recommends and sells approved sensors. It is the responsibility of the customer to ensure that all sensors used with the **EnCompass** have the appropriate approvals.

9. Application Examples

Below are application examples of the comprehensive monitoring capability of a single **EnCompass** when used to monitor utility systems.

INPUT	MOTOR/PUMP	CHILLER	BOILER	COOLING SYSTEM
Power 3 x Voltage, 1 x Neutral	Main Drive	Compressor	Forced Draft Fan	Recirculation Pumps or Fans
Power 4 x Current Transformers	Main Drive	Compressor	Forced Draft Fan	Recirculation Pumps or Fans
Temperature 1	Bearing Temperature	Chilled Water Flow	Supply Temperature	Supply Temperature
Temperature 2	Stator/Winding Temperature	Chilled Water Return	Return Temperature	Return Temperature
Temperature 3	Ambient	Condenser Water Flow	Flue Gas Temperature	Exit Air Temperature
Temperature 4	Process	Condenser Water Return		Motor Bearing Temperature
Temperature 5		Evaporator Refrigerant Temperature		
4-20mA Input 1	Bearing Vibration	Refrigerant Pressure	Gas/Oil Consumption	Cooling Water Flow
4-20mA Input 2	Speed/Flow Rate	Chilled Water Flow Rate	Steam Flow/Pressure	Fan Speed/ Air Flow
4-20mA Input 3	Pump Discharge Pressure	Compressor Vibration	Oil/Water Tank Level	Pump/Fan Motor Vibration
Digital Input 1	Motor Status	Chiller Status	Boiler Status	Tower Fan Status
Digital Input 2		Purge Unit Runtime	Alarm	
Serial Input		Ambient Temperature & Humidity	Ambient Temperature & Humidity	Ambient Temperature & Humidity

Appendix - Additional Information

A.1 – Resin Fill Information

A large part of the circuitry is resin potted. This provides structural and thermal stability to the internal workings of the node. The components are protected from any physical and most chemical risks. The resin also provides UV absorption.

Robnor Resins EL171H

A semi rigid, room temperature curing, flame retardant polyurethane resin system.

DESCRIPTION

Basic	Two-component polyurethane system
Resin	RL171H
Hardener	HL171H
Application	Key Properties
Encapsulation of Transformers	Non-toxic
Cable Joints	UL94-V0 @ 6mm
Wide range of substrates	Excellent adhesion
Low to medium voltage electrical and electronic applications	High thermal conductivity
	Economical

PHYSICAL DATA (APPROX. VALUES)

Description	Resin	Hardener	Mixed
Colour	Black	Amber	Black
Colour	Beige	Amber	Beige
Specific Gravity	1.72	1.24	1.65
Viscosity (mPas) @ 25°C	19000	200	6000

CURE SCHEDULE (150ML SAMPLE)

Temperature	Working Life (minutes)	Gel Time (minutes)	Light Handling (hours)	Full Cure (hours)
RT (20-25°C)	20	40	24	48
60°C	-	-	2	4
80°C	-	-	1	2

TYPICAL PROPERTIES

	Test	Result	Unit
	Operating Temperature	-40 - +125	°C (application & geometry dependant)
	Flammability	6mm	UL94-V0
Peak Exotherm	(250g @ 20°C)	40	°C
	Shrinkage	0.5	%
	Volume Resistivity	12 ¹⁰	Ohm.cm
	Surface Resistivity	12 - 14 ¹⁰	Ohm.cm
	Dielectric Strength	16	kV/mm
	Permittivity (ε)	4.6	50Hz
	Loss Tangent (Tanδ)	0.04	50Hz
	Hardness	90	Shore A
	Heat Deflection Temperature	Flexible	
	Water Absorption (30 days @ 25°C)	0.54	%
	Thermal Conductivity	0.75	W/mK
	Coefficient of Linear Expansion	60 - 80	Ppm/°C
	Elongation at Break	~30	%
	Comparative Tracking Index	>600	v

APPROVALS

RoHS Compliant	Yes
UL94-V0	6mm
REACH (SVHC Concentration)	0%

A.2 – Safety Features

A.2.1 – Mains Safety

Mains inputs are electrically isolated from all other inputs and outputs.

A.2.2 - Cage Clamp Terminals

Cage clamp type terminals ensure the wires are secure and held reliably, thus the connections have an increased durability and stability.

Power terminals conductor size is equal to 0.75mm² and low voltage terminals conductor size is equal to 0.5mm². Recommend using 0.5mm² pin ferrule crimps for easier termination.

A.2.3 - ABS Casing Material

The casing material used for the **EnCompass** is acrylonitrile butadiene styrene (ABS) a compound which has been formulated to meet the static dissipative requirements of the ATEX Directive, thus meeting specific safety requirements. The Casing has high impact strength and ductility, good chemical resistance and abrasion resistance. The material is nontoxic, thus handling of the node has no inherent safety risks. The casing material has high strain tolerance and good resistance to ultraviolet light.

A.2.4 – Electrical Static Discharge (ESD)

All inputs and outputs are protected against ESD.

A.3 – Flammability Ratings

The ratings are as follows:

- 5VA: burning stops within 60 seconds on a vertical specimen with no drips; specimens do not develop a hole.
- 5VB: burning stops within 60 seconds on a vertical specimen with no drips; specimens may develop a hole.
- V-0: burning stops within 10 seconds on a vertical specimen; non-inflamed particles may drip.
- V-1: burning stops within 30 seconds on a vertical specimen; non-inflamed particles may drip.
- V-2: burning stops within 30 seconds on a vertical specimen; flaming particles may drip.

Enclosure Material (UL-94 1.5mm) V-0

Enclosure Material (UL-94 2.0mm) 5VB

Enclosure Material (UL-94 3.0mm) 5VA

Resin (UL-94 6.0mm) V-0

A.4 - Description of Wiring Terminal Connections

Terminal Number	Input	Label	Connection	Description
1	45/230 VAC Voltage Ref	Phase 1	V1	Electricity Monitoring
2	45/230 VAC Voltage Ref	Phase 2	V2	Electricity Monitoring
3	45/230 VAC Voltage Ref	Phase 3	V3	Electricity Monitoring
4	45/230 VAC Voltage Ref	Neutral	N	Electricity Monitoring
5	Current Transformer	CT Phase 1	I1A	Electricity Monitoring
6	Current Transformer	CT Phase 1	I1B	Electricity Monitoring
7	Current Transformer	CT Phase 2	I2A	Electricity Monitoring
8	Current Transformer	CT Phase 2	I2B	Electricity Monitoring
9	Current Transformer	CT Phase 3	I3A	Electricity Monitoring
10	Current Transformer	CT Phase 3	I3B	Electricity Monitoring
11	Current Transformer	CT Neutral	INA	Electricity Monitoring
12	Current Transformer	CT Neutral	INB	Electricity Monitoring
13	Serial	Ack	1 Ack	Serial Data/Hum-Temp
14	Serial	Vdd	2 Vdd	Serial Data/Hum-Temp
15	Serial	Ground	3 Gnd	Serial Data/Hum-Temp
16	Serial	Data	4 Data	Serial Data/Hum-Temp

17	Digital Output	Output	Op A	Triac On-Off / Pulsed
18	Digital Output	Output	0V	Triac On-Off / Pulsed
19	Digital Input No1	Input	In A	Status / Counter
20	Digital Input No1	Input	0V	Status / Counter
21	Digital Input No2	Input	In B	Status / Counter
22	Digital Input No2	Input	0V	Status / Counter
23	Thermistor Input No1	10K3A1 (10k,20k,Pt)	T1+	Temperature
24	Thermistor Input No1	10K3A1 (10k,20k,Pt)	T1-	Temperature
25	Thermistor Input No2	10K3A1 (10k,20k,Pt)	T2+	Temperature
26	Thermistor Input No2	10K3A1 (10k,20k,Pt)	T2-	Temperature
27	Thermistor Input No3	10K3A1 (10k,20k,Pt)	T3+	Temperature
28	Thermistor Input No3	10K3A1 (10k,20k,Pt)	T3-	Temperature
29	Thermistor Input No4	10K3A1 (10k,20k,Pt)	T4+	Temperature
30	Thermistor Input No4	10K3A1 (10k,20k,Pt)	T4-	Temperature
31	Thermistor Input No5	10K3A1 (10k,20k,Pt)	T5+	Temperature
32	Thermistor Input No5	10K3A1 (10k,20k,Pt)	T5-	Temperature
33	4-20mA Input No1	4-20mA	IS1+	Any Loop Powered 4-20
34	4-20mA Input No1	4-20mA	IS1-	Any Loop Powered 4-20
35	4-20mA Input No2	4-20mA	IS2+	Any Loop Powered 4-20
36	4-20mA Input No2	4-20mA	IS2-	Any Loop Powered 4-20
37	4-20mA Input No3	4-20mA	IS3+	Any Loop Powered 4-20
38	4-20mA Input No3	4-20mA	IS3-	Any Loop Powered 4-20

A.5 – Cable Specifications

Input / Output Type	Unit	Min/Max	Cable Type	Size mm ²	No. Cores	Overall Diameter	Environment
Voltage	AC Volt	45/230			4	4.0mm	Internal Non-Armoured
Voltage	AC Volt	45/230			4	4.0mm	Internal Armoured
Voltage	AC Volt	45/230			4	4.0mm	External
Voltage	AC Volts	45/230			4	4.0mm	External Armoured
Voltage	AC Volts	45/230			4	4.0mm	Hazardous
Current Transformer	mA/mV	75/333			8	5.0mm	Internal
Current Transformer	mA/mV	75/333			8	5.0mm	External
Current Transformer	mA/mV	75/333			8	5.0mm	External Armoured
Current Transformer	mA/mV	75/333			8	5.0mm	Hazardous
Thermistor Inputs					8	5.0mm	Internal
Thermistor Inputs					8	5.0mm	External
Thermistor Inputs					8	5.0mm	External Armoured
Thermistor Inputs					8	5.0mm	Hazardous
Digital Inputs	Contact	VoltFree			8	5.0mm	Internal
Digital Inputs	Contact	VoltFree			8	5.0mm	External
Digital Inputs	Contact	VoltFree			8	5.0mm	External Armoured
Digital Inputs	Contact	VoltFree			8	5.0mm	Hazardous
4-20mA	mA	4-20			4	5.0mm	Internal
4-20mA	mA	4-20			4	5.0mm	External
4-20mA	mA	4-20			4	5.0mm	External Armoured
4-20mA	mA	4-20			4	5.0mm	Hazardous

A.6 - Sampling Frequencies and Storage

A.6.1 - Continuous sampling

Current and voltages are sampled at 500Hz. This allows electricity consumption to be calculated accurately.

A.6.2 - Regular sampling

For all inputs, the sampling rate for the data to be logged and reported is configurable at node level. The options are:

30 seconds

1, 2, 3, 5, 6, 10, 15, or 30 minutes

1, 2, 3 or 4 hours

A.6.3 - Digital event recording

When a digital input is configured to report all changes of status, it will recognize and log every time the input changes, regardless of the sampling rate.

A.6.4 - Storage and Capacity

The device is able to store data until its buffer of 32 million values is full, at which point new values will overwrite the oldest values.

A.7 - Required TCP or UDP Ports



They may need to be unblocked by a firewall.

The following TCP or UDP ports will be required, if the specified functionality is used. Port numbers shown with an asterisk can be changed in the settings for that functionality.

Functionality	TCP Ports	UDP Ports
LAN, Inbound		
All configuration pages	80	
Modbus TCP, gateway as Slave	1502*	
LAN, Outbound		
Local Time Server (NTP)		123
Modbus TCP, gateway as Master	502*	