Cable Smart Installation Guide - MCU and Autoloop

GK23000140

V1.1

July 22

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All installations shall be done in accordance with the relevant electrical wiring standards and in line with the operating, installation and safety procedures of the company carrying out the installation. These standards and procedures shall at all times take precedence over this document. It is recommended that a safety assessment be carried out before carrying out any retrofit installations prior to starting work. This install guide assumes that the feeder pillar and lighting column has been isolated before work starts.

The GridKey team are able to offer in person or remote training and also installation services if required.

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1   GridKey Installation In Feeder Pillar

The GridKey MCU is designed to be installed in electrical pillars/distribution boards and measures 3 phase voltage and the current in upto 6 off 3 phase circuits or 18 off single phase circuits or any combination to a maximum of 18 current inputs per unit. Should there be more circuits than that an additional MCU would be required to be fitted.

The MCU is a compact electronics unit with an integral modem and antenna. The unit is pre-fitted with voltage leads. The unit is of plastic construction and does not require an earth connection.

The current sensors are of two type – small clip-on CTs or rope Rogowski sensors. Typically the CTs will be used in Cable Smart installs and measure to a maximum of 100A.

1.1   GridKey MCU Physical Install

The MCU can either be mounted on the wooden backboard of the feeder pillar or to the metal work of a steel cabinet. It should be mounted so that the cable exits are pointing downwards. Dimensions are shown below.

Remove the lid of the MCU up undoing the security torx screws and opening the lid to 90 degrees and then lifting the lid off.

Important: Ensure that water or dirt do not get into the MCU when open.

The MCU has three mounting holes and either woodscrews or magnetic mounts can be fitted using the screws and nylock nuts supplied. A small allen-key and pliers are required to fit the mag-mounts.

Mount the base of the MCU in the required location using the woodscrews or mag mounts.
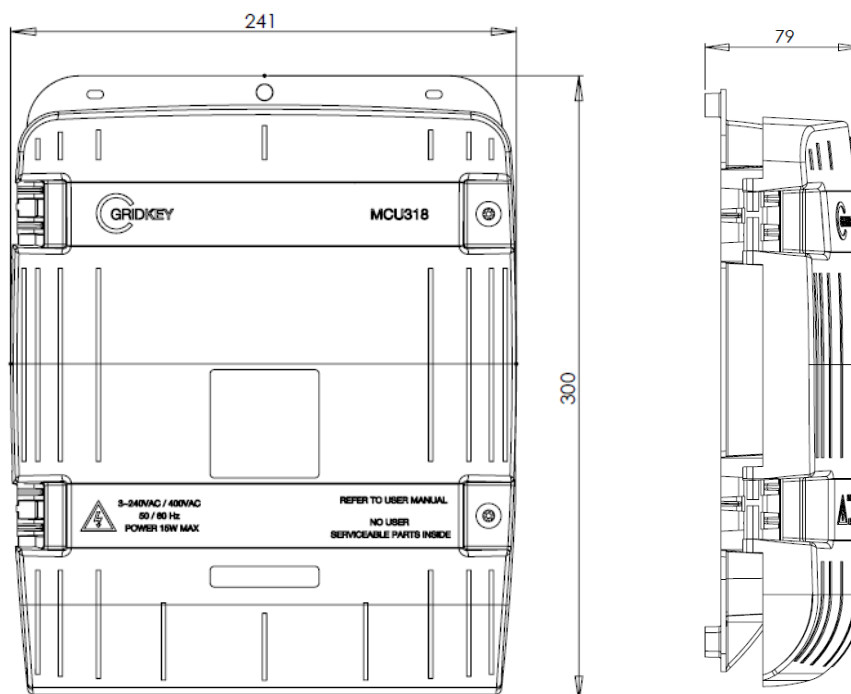
Normally the MCU will be mounted internally within the feeder pillar however the system is rated to IP54 so an external mount could be considered however to ensure that there is no risk it should be

made secure specifically around the voltage leads. This should be subject to the installation companies own processes.

1.2   Fit the Current Sensors

Current sensors should be fitted to all outgoing circuits – the sensors are normally fitted on the load side of any protective devices (MCBs or fuses). The system will sum these outgoing circuits and produce a calculated total load so there is no need to measure the incoming cables. Three sensors are wired into a single connector which fits in the MCU – this is known as a Sensor Assembly. By default the three sensor are set to be L1 (brown), L2 (black) and L3 (grey) although it is possible to override this in the configuration app.

To fit the sensors determine the correct sensor assembly type to be used and the cable length required. Two types are available:

- Miniature split core CTs with either 2m or 4m cables – these will fit cables upto 25mm2 and can measure up to 100A per sensor
- Flexi Rogowski "rope" sensors with 3m cables – these will fit cables upto 300mm2 and can measure up to 1000A per sensor

Typically miniature split core CTs are used with 2m cables.

Important: due to the small signal levels from these sensors it it not possible to change the cable length of these in the field.

It may be necessary to use a 25mm gland to exit the sensor cables from the distribution box within the feeder. This size is required in order to pass the sensor assembly connectors through the gland.

To fit the CTs, unclip the top of the sensor, connect around the circuit cable to be measured and then clip the sensor shut.

To fit the rope Rogowski sensors either twist the bayonet ring on the sensor or simply pull the sensor apart.

Important: the sensors need to be fitted the correct way around - there is an arrow embossed on the CT – this should point towards the load (ie the lighting columns).

The photograph below shows the CT sensor assemblies installed in a cabinet. The 25mm gland can be seen on the right hand side.
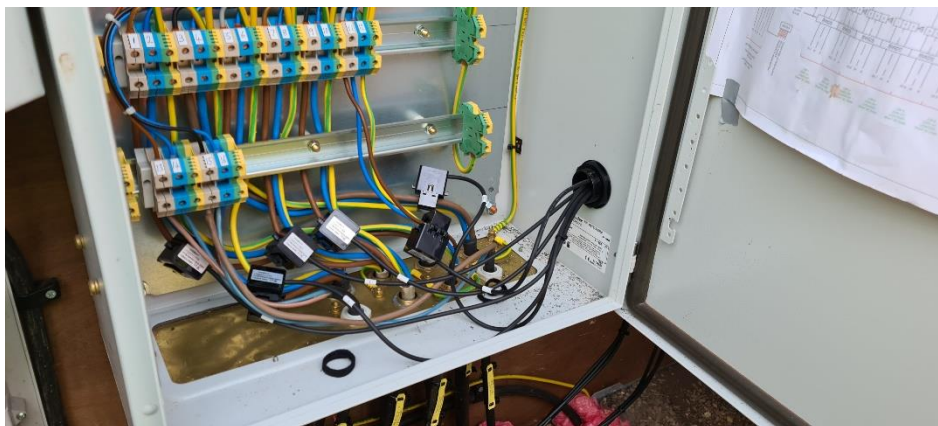
The sensor assembly cable shall be routed to the MCU and plugged into the MCU – this is done by carefully positioning the connector in the cable guides of the MCU and gently pushing the connector into place until the top of the connector is level with the guides. The connectors for circuit 1 should be plugged in the left hand side connector of the MCU and then the MCU populated moving to the right.
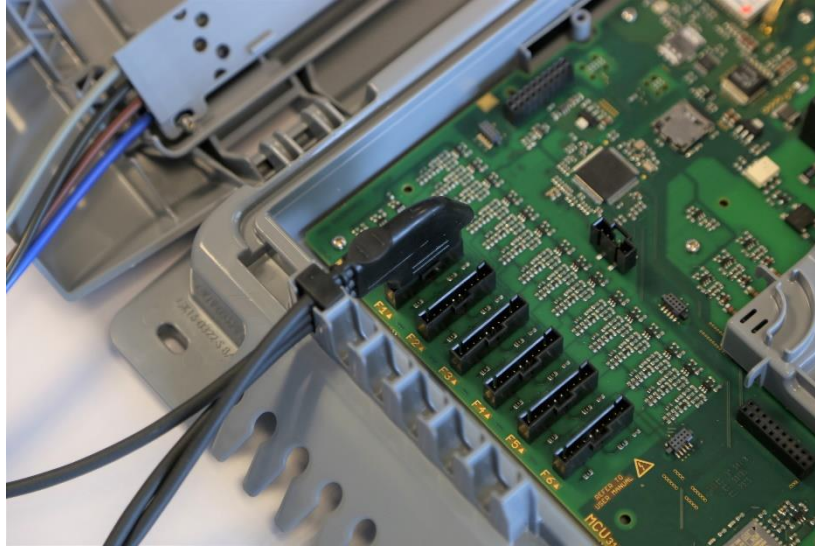
The picture above shows a sensor assembly connected to the circuit 1 position.

Important: the MCU will come supplied with foam gaskets in the cable assembly guides. Only remove these as required – unused guides must still have the foam gasket fitted so that the IP rating is maintained.

1.3   Fit the Voltage Leads

The voltage leads come pre-fitted to the lid of the MCU and have an inline fuse. Two types of fuse are fitted – in the L1 (brown) and N (blue) cables is a 32mm 10A FF ceramic fuse and in the L2 (black) and L3 (grey) cables is a 32mm 500mA FF ceramic fuse. The voltage cables themselves are double insulated 0.5mm2.

The end of the voltage leads is a pre-tinned bared cable, these need to be connected to the three phase incomer cables and a neutral point, normally they connected below the main isolator so that the whole pillar including the GridKey MCU can be isolated from a single switch.

The voltage cables should be suitably routed and connected – they can be cut to length if required.

The MCU lid can then be reattached and closed – refitting is the reverse operation to removing – ie put the lid at 90 degrees to the base and re-attach the hinge. Push down on the lid to ensure it is correctly aligned and do up the security torx screws.

The picture above shows an MCU mounted using the magnetic mounts on the side of a pillar. The voltage cables can be seen with their inline fuses and the current sensor cables exiting at the bottom of the MCU.

The picture on the left hand side shows an MCU mounted on the wooden back-board and uses rope Rogowski sensors.

1.4   Commissioning the GridKey MCU

Once installed the Connect3 commissioning tool is used to both programme the unit and also to check correct installation and operation.

The Connect3 tool is available for use on both iOS and Android tablets/phones plus a PC version is available.

The App can be downloaded from either the Android Play Store or the iOS App Store – search for "GridKey" will find the app. It can then be downloaded but to unlock it a passcode is required – this is available from the GridKey team info@gridkey.co.uk or through an admin contact within the installing company.

Connect3 is often being updated to add new features - full operating instructions for the latest version of Connect3 are available from the GridKey team (or via the help button in the Data Centre), the following provides a high level set of guidance.

Although not essential for MCU installs/commissioning, also having access to the GridKey Data Centre is preferred as this allows the end to end data connection to be checked while on-site.

The MCU connects to the Connect3 app/PC via a built in WiFi wireless link. The MCU creates a unique SSID identity (which is always of the form MCU_XXXXXXXXXXXX where X is the 12 digit serial number on the side of the MCU) and a pseudo-random password. The App/PC will make a point to point connection with the MCU.

Important: for security reasons the WiFi is only available for 5 minutes from power up – if the WiFi switches off it is necessary to power cycle the MCU. Once the app/PC has connected however the WiFi will stay enabled until the app is disconnected.

Important – when connected to the MCU via the WiFi, the phone/tablet will lose its internet connection (either via GSM or other WiFi) – disconnecting from the MCU will restore the internet.

1.4.1   GridKey MCU Commissioning Process

Firstly power up the pillar and also the MCU. Ideally also manually over-ride and switch on the lighting circuit so the lanterns are drawing current.

There are no indicator lights on the MCU – to check it is functioning we recommend checking the list of available Wi-Fi networks on either the tablet/phone or PC and ensure there is Wi-Fi network listed in the form of MCU_serial number.

Now connect the tablet/phone/PC to the MCU using the Connect3 app. It may be necessary to select the correct serial number by either typing in the serial number of scanning the QR code on the side of the unit.
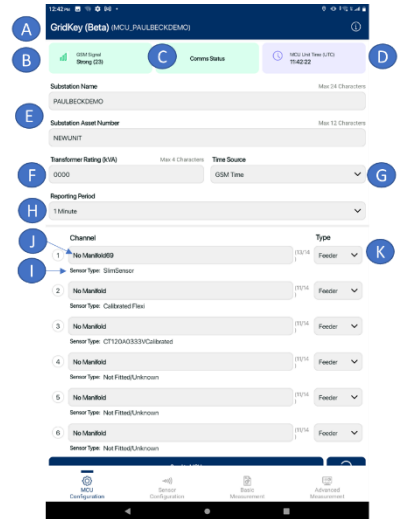
Once connected this will take you to configuration page where the name and number of the feeder pillar can be input along with the names of the outgoing circuits. The time stamp source should be pre-programmed in the unit and set to data centre time and the reporting period to 10 minutes.

It is also possible to change the phase of individual sensors as well – instructions for this are included in the Connect3 guide. The lat/long co-ordinates for the install location are automatically added from the GPS in the phone/tablet.

Any changes need to be sent to the MCU and this is done by clicking on the "Save" button.

Once any changes have been completed, move to the Basic Measurement tab. This shows the voltage and current measurements as well as the phase angle between the voltage and current for each of the sensors fitted.

The following should be checked:

- The "Comms Status" should be green (this indicates two way comms with the clod based data centre) and the signal strength should ideally be green. However lower signal strengths may work alternatively an external antenna can be fitted. Antenna kits are available from GridKey however it is very rare they are needed.
- The three voltages should all register in the 200-260v range
- All the currents should be positive – if the lanterns are illuminated we would expect a current in the range of 5A to 30A – obviously this will be dictated by how many columns are connected to each specific circuit.
- The phase angle for each sensor should be in the range of +/-45 degrees.
  - If the phase angle is in the region of +120deg or -120deg then the sensor is connected to the wrong phase
  - If the phase angle is in the region of 180deg then the sensor is fitted upside down

If the installer has access to the GridKey data centre they should now connect to that and search for the specific serial number and check data is coming through.

Any issues with installs please contact the GridKey team.

# 2   Installation of Autoloop Devices in Lighting Columns

The Autoloop devices consist of a compact unit designed specifically to fit inside lighting columns. The unit consists of a plastic cabinet which has a GSM antenna at the top and a length of 3 core cable exiting from the base of the unit through a grommet.

Internally the unit has two circuit boards, one being the main processor and metrology board and the second being the GSM modem. Also internally is the sim card and an SD card. On the outside is a single tri-colour (red/amber/green) LED visible through a window on the top of the unit.
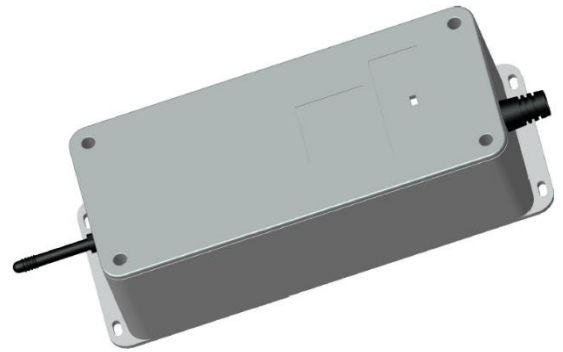
There is no need to access internally within the unit so the lid should never be removed.

The unit is rated to IP54. The dimensions of the unit are as follows:
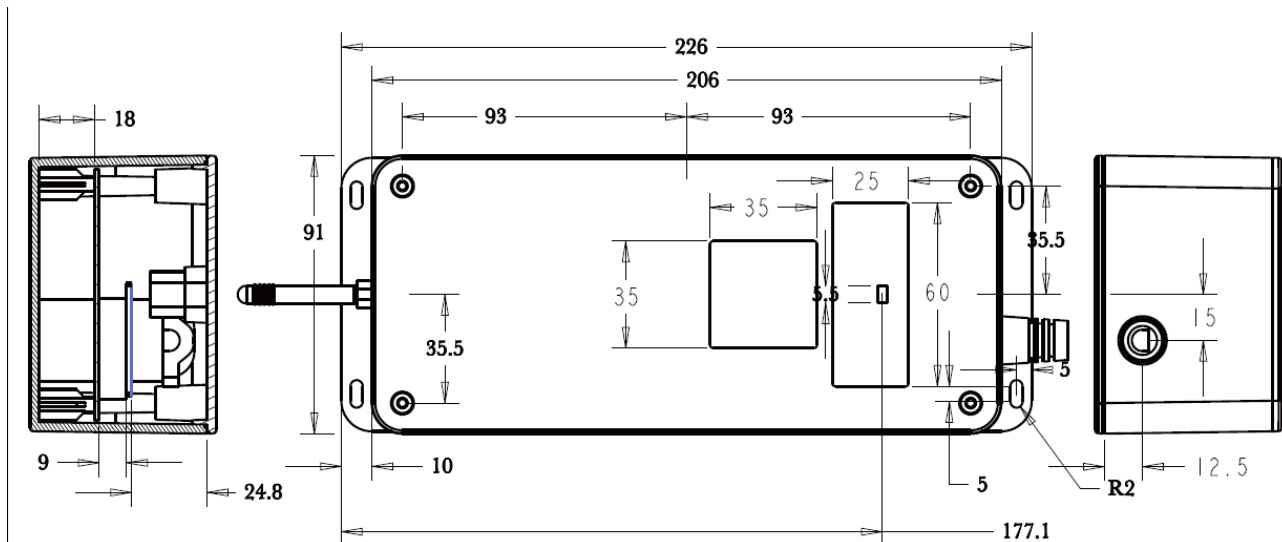
2.1   Physical Installation and Wiring

Before installing, the GSM antenna should be fitted to the unit – the antenna is loose in the packing box with the Autoloop and simply screws into the SMA connector on the top of the unit. It should be finger tight and then done up between 1/8 and ¼ of a turn using pliers or a small spanner.

The door of the column should be removed to provide access to the cut-out, the earth block and the wooden baseboard which the cut-out is mounted to.

The Autoloop should be securely fastened in place using two or more of the screw holes in the base plate of the unit. Normally this would be screwed directly into the wooden back board in the column. In some cases it may be necessary to loosen or move the cut-out to create the required room. The unit can be installed either way up – ideally the antenna would be close to the column door to improve

signal strength. Electrical connections are simply a single phase 3 wire connection – live, neutral and earth. Cut to length and strip back the insulation from the flying lead cable from the Autoloop device and connect the live and neutral into the top of the cut out and the earth into the earth block in the column. It is important that these are good electrical connections and if needed ferrules can be crimped onto the autoloop cables.

The photographs above show an Autoloop installed in Area 9.

2.2   Commissioning the AutoLoop

Once the installation is complete, the Autoloop should be powered – either it would have been isolated from the feeder pillar or by disconnecting the cut-outs in the column.

2.2.1   Local check

There is an LED on the unit which after about 20 seconds will illuminate red, then go to amber and then green – this indicates that the unit has power, has connected to a GSM network and established two way communications with the cloud based data centre. If after 1 miinute the LED has not illuminated, check the power is on and the unit is wired correctly. If with five minutes the LED has not gone green then power down and check the antenna is connected. If any further problems please replace with a new unit. The phots in section 2.1 above show the LED indicating green.

2.2.2   Configuration Tool

Unlike the MCU there is no mechanism to connect locally to the Autoloop instead a web-based tool is used and this then sends the relevant information through the Data Centre to the Autoloop device.

The AutoLoop conifg tool is often being updated to add new features - full operating instructions for the latest version are available from the GridKey team (or via the help button in the Data Centre), the following provides a high level set of guidance.

The AutoLoop Conifg Tool can only be accessed through the GridKey Data Centre – this is part of the necessary cyber security measures. It is therefore necessary to have a valid Data Centre log-in – this can be obtained from the GridKey team (info@gridkey.co.uk) or through a system admin.

If the config tool is to be used locally when doing the install it is also necessary to have either a tablet or phone with GSM connectivity – we recommend 4G or 5G.

It is also possible to update the

Log on to the GridKey Data Centre and the main top-level dashboard will be displayed.
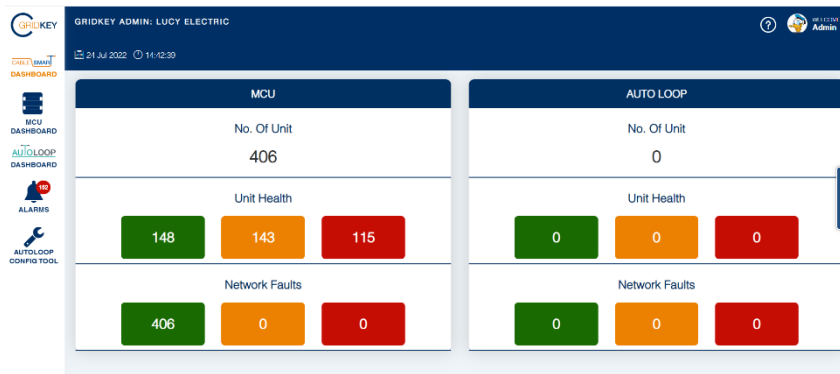
The Autoloop Config Tool is available from the menu bar on the left hand side of the screen. This will open the main dashboard for the config tool:
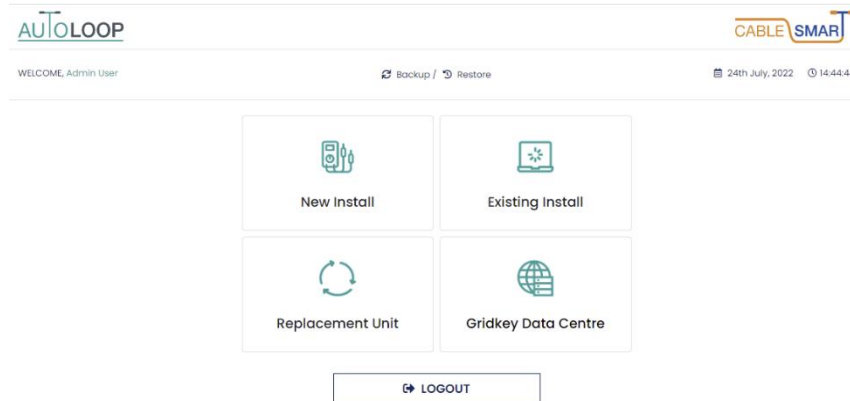
If installing a new unit select the "New Install" page – this will only allow you to install if the unit has not been previously registered on the data base. If the unit has been previously installed or to change settings in an existing unit select the "Existing Install" page. If a unit is being exchanged select the "Replacement Unit" page – this will automatically move all settings from the old unit to the new one.

When installing a new unit various information is required:

- Autoloop Serial Number, Customer name, Project Name and Part Number – these can all be input automatically by scanning the QR code on the top of the AutoLoop
- Installation details – these are auto-populated using the username used to log in to the data centre and the time/date from the tablet/phone.
- Install location – asset number is mandatory (this is the number on the side of column), lat and long and EPS ID if known. Lat/long will be autopopulated from the tablet/phone if using it locally – if updating remotely the lat/long can be manually input.

- Power Source – this is the feeder pillar it is supplied from – Asset Number, type of Lighting Control, circuit number and phase are mandatory, EPS ID, MCU serial number (if one is fitted in that pillar) and circuit name are optional.
- Protective Device – this is the fuse/MCB which is protecting that specific circuit in the feeder pillar – both the type and rating are mandatory and are accessed through drop down menus which are based on the protective device types detailed in BS7671.
- The Reporting Frequency should already be pre-programmed to be 1440 minutes for the measurement reports and 180 minutes for the status reports.

When all these inputs have been made click on the save button at the bottom of the page. When prompted if the unit install is complete, clicking on yes will lock the unit so further changes cannot be made unless the unit is "unlocked" by a system administrator.

2.2.3 GridKey Data Centre

Going back to the GridKey Centre main dashboard page, clicking on the AutoLoop Dashboard page (left hand menu) will go to the page that shows the status of all the Autoloop units currently connected. It is then possible to search for a specific unit (only the last 5 digits of the serial number need to be typed into the search bar.

Once the unit has been located on the dashboard, the "Unit Health" for that unit should show amber or green – this indicates that the unit is communicating with the data centre successfully.

3   More Information

If there are any issues when installing or if damage to equipment is detected please contact the GridKey team using the following details:

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W: www.gridkey.co.uk

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                Basildon
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