Ver. 1.0

M2M – Full Operation Manual

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Introduction

Wireless communication by means of M2M devices is of strategic importance for the Daikin on Site success.

Daikin on Site offers communication also via existing customer LAN, which in principle is "free of charge", whereas this kind of connection typically need to be accepted by the customers' IT department, including configuration of firewalls, network cabling to be established etc., causing effort and costs to both the stakeholders.

Due to security concerns, a LAN connection will in many cases not be accepted by IT departments, even though the Daikin on Site communication is as secure as Internet Banking.

Therefore, a scenario where all equipment is leaving the Daikin factory with the wireless M2M communication system would be an ideal solution, since communication is then straight between Daikin equipment and Daikin on Site, but in turn such a scenario represents costs:

- The cost of a router, properly power supply and an external antenna.
- The monthly cost of communication (SIM).

Moreover, a preliminary verification on site can be required to ensure adequate signal coverage with the mobile operator provided by DAE (TiSparkle from 2020) or possibly with local mobile third parts operators (for which, however, DAE cannot provide any kind of assistance). The list of operators by area is available at chapter "6 M2M SIM Coverage and bundle".

1. Daikin M2M devices (over time)

Below, the list of DAE M2M device kits provided by DAE along time (this kit also known as OP155 or “Option 155") is presented.

DAE M2M device kits
2017 to February 2020 – Current Status: phased out • MODEM ROUTER MACHINELINK 3G • SIM Vodafone This is the first bundle of DAE M2M kit. Being a 3G technology now being sold, this kit is phasing out.
February 2020 to August 2020 – Current Status: phased out • Teltonika 4G RUT240 M2M Kit • SIM Vodafone A new kit that introduces the new Teltonika 4G RUT240 M2M Kit. It is programmed with DAE customed software that direct some connection info to Daikin on Site and allow remote maintenance in the next future. In this timeline is still using the Vodafone SIM and will be replaced by the newer kits that include the TiSparkle SIM.
August 2020 to date – **Current Status: available for sale** • Teltonika 4G RUT240 M2M Kit • TiSparkle SIM The newest kit with Teltonika 4G RUT240 M2M router. It is programmed with DAE customed software that direct some connection info to Daikin on Site and allow remote maintenance in the next future. The new SIM TiSparkle allow DAE support to keep a better verify of SIM connection, status, monthly traffic data and, on request, to manage the SIM fee contract. In case customer want to change SIM with another of its choice, it is necessary to follow these steps: 1. Communicate to Smart Center – DAE (dos.administrator@daikinapplied.eu) the ICCID number of the SIM provided so that we can deactivate it, as well as the serial number and MAC address (LAN MAC) of the associated router. Please, send clear and readable pictures. 2. Perform a reset of the router or reprogram it (this feature is now – January 2022 – in beta test with some DAE affiliates). It possible to acquire the kit without the TiSparkle SIM provided by DAE. In this case the router will be programmed as “Third Part” so that the customer can use a desirable own SIM. More details at chapter “8 DAE M2M device with a third part mobile operator”.

2. DAE M2M Router kit

The kit is composed by:

- Kit Router Teltonika RUT240
- Add-ons for power supply, electrical and mechanical for installation and connection of the device.

DAE M2M Kit (1/2) - Teltonika RUT240 kit (box content)

1 - Modem Teltonika RUT240
2 – Ethernet Cable
3 – Power cable with Tamiya 4-pole connector
4 - DIN rail mounting adapter + screws
5 – Tool for SIM removal
6A - 2x LTE Antennas Stick
6B – Wi-Fi Antenna Stick
7 – Quick user guide
8 – Box RUT240

DAE M2M Kit (2/2) - Additional components			
			
Power Supply - MEAN WELL AC/DC 10W	Antenna with magnetic base - PANORAMA ANTENNAS MAR-7-21-2SP	Strain - ELEKTROZUBEHOR TEC-S M1606.3,5.10 L Seal - ELEKTROZUBEHOR CPN 13,3.5.5,5 ferrule - ELEKTROZUBEHOR P-CC32 M16 06.22	Chassis Cap - ELEKTROZUBEHOR TFC M16.18L ELEKTROZUBEHOR CT M16.20

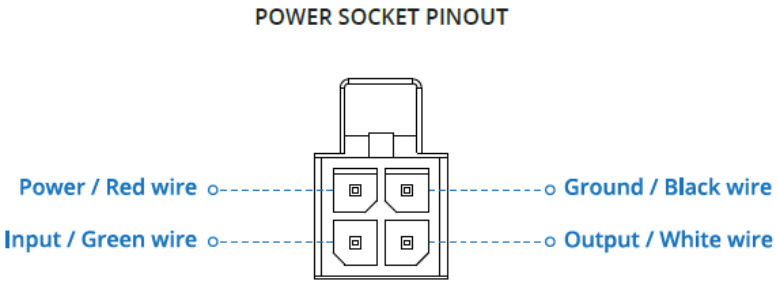
The kit is composed of two different types of antennas. With reference to the previous tables:

- 2 stick antennas LTE (6A) - included kit Teltonika RUT240 Box
- 1 Wi-Fi stick antenna (6B) - included kit Teltonika RUT240 Box
- 1 Antenna with magnetic base PANORAMA ANTENNAS MAR-7-21-2SP – additional component

The additional magnetic base antenna just substitutes one of the two LTE stick antennas (6A) included in the Teltonika RUT240 kit. Considering the following figure as an exhibit:

- The Wi-Fi antenna (6B) included in the Teltonika kit has to be connected to SMA “WiFi” male connector
- One of 2 LTE stick antennas (6A) in the Teltonika kit has to be connected to the central female SMA "Mobile" connector
- On the female SMA Mobile connector on the right has to be connected the additional antenna with magnetic base PANORAMA ANTENNAS MAR-7-21-2SP. The cable to connect this antenna should avoid overlapping with inductive elements (coils, relays, etc.) which could cause electromagnetic noise. It should pass throw the panel hole with the provided fairlead.

The power is supplied by a Mean Well 12 Vdc and wired to the router using the appropriate cable with 4-pole Tamiya connector (3) included in the Teltonika Kit. It is necessary to connect the power supply only the red cable (+) and black (-) according to the polarity, while the other two cables (green/white) should be appropriately insulated (e.g., with tubing or on terminal block with which the cable is equipped in origin).

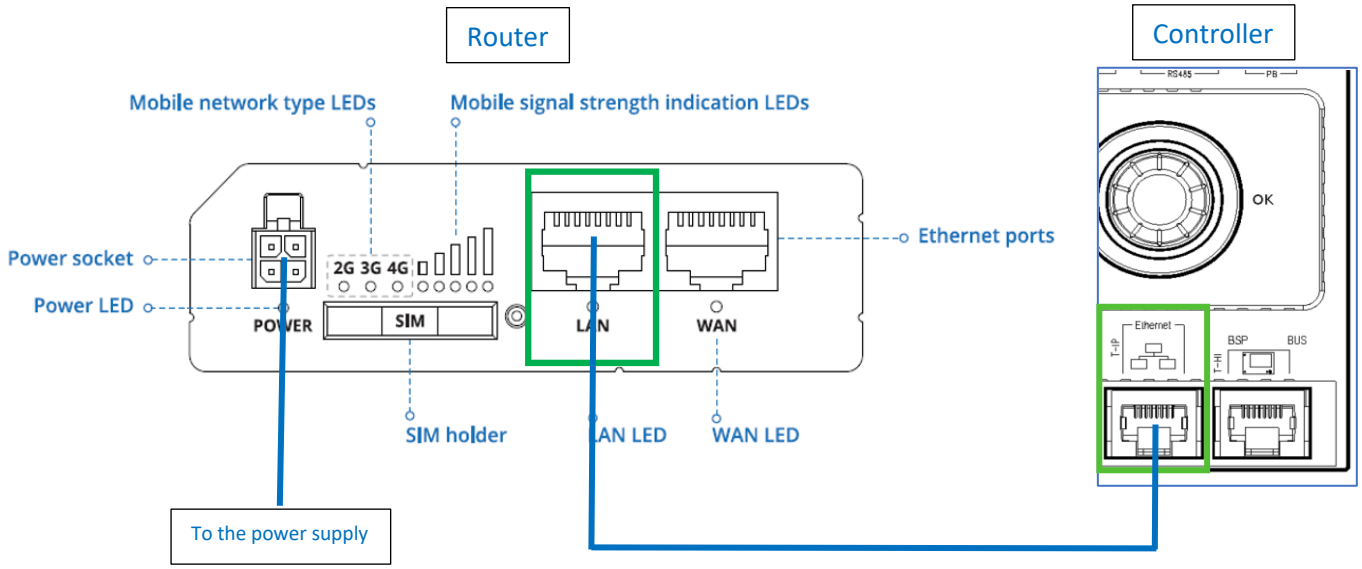


After the installation, the device and the Teltonika Microtech III/IV should already be connected (using a network cable patch category 5S or higher) between the LAN port of RUT240 and the Tip MTIII/MTIV Controller port.

For units commissioned after February 2021, the WAN port is usable by maintainers for connecting to the controller without disconnecting the router.

Every other use of this port is not considered. E.g., connection of other devices to the router is not supported.

The amount of data per month is tailored and limited to ensure the correct connection of the controller to DoS. Since the starting months of 2022 all SIMs provided by DAE will restrict the traffic to the exclusive connection of DoS services.



2.1. Importance of the external antenna installation

The PANORAMA ANTENNAS MAR-7-21-2SP with magnetic base, supplied with the DAE M2M kit (or any equivalent antenna), must be installed externally to the Operator Panel cabinet.

The lack of such antenna or the accidental installation inside the operator panel invalidates almost completely the reception of any M2M device and therefore makes it virtually impossible to connect to Daikin on Site.

Please note: this case is applicable not only for DAE M2M Kit, but for almost all the M2M devices. If customer would like to connect any 3/4/5G device to internet, it must reach a proper signal. Antennas must not be insulated.

WARNING: antenna must be installed vertically, possibly far from obstacles, so that the signal is the best reachable on site.

By "vertically" we mean with the magnetic base attached to a horizontal plane.

DO NOT install the way visible in the picture below, because this configuration doesn't follow the radiation pattern of the antenna, therefore it doesn't work properly.

3. Unit controller MTIII/IV configuration to communicate with DAE M2M device

The software configuration of the Control Unit Microtech III/IV with respect to the M2M devices is usually performed at the end of the factory production processes, but in some cases, it may be necessary to carry out an inspection of the settings or enter them manually in the case of installation of the kit M2M after sales.

NOTE: Customer can also connect the M2M device by configuring controller unit in DHCP mode, however, to enable integration with other DAE application and full remote management support, it is strongly recommended to set a fixed IP as follows.

Technician must access MTIII/IV Controller HMI and entering the 4-digit password to configurate it, after that:

1. Navigate to the IP configuration submenu, generally View > Set Unit > CTRL IP Setup
2. Set the following values
    - DHCP= Off
    - Gvn IP = 192.168.1.42
    - Gvn Msk = 255.255.255.0
    - Gvn Gwy = 192.168.1.1
    - Primary DNS = 192.168.1.1
    - Secondary DNS = 0.0.0.0
3. Apply the new configuration setting in the same submenu
    - Apply Changes = Yes.

WARNING: This will cause the unit reboot. Please, ensure that the unit is not operating or follow the correct power off procedure before to apply the new configuration.

The new configuration will allow the controller to negotiate and take the IP address assigned by the router directly, then it will be able to connect to Internet and in turn to Daikin on Site.

4. About new customized DAE RUT240 router

Since the replacement of the old Vodafone Machine link 3G Modem with the new Teltonika RUT240 router, DAE is including a customized software into this Linux-based OS router.

Our customization includes internal programs/configurations/scripts we developed to obtain dedicated info and datapoints that keep trace of traffic, bandwidth, signal strength, geolocation of the cell in use (only on newest controller Application software) and a possibility for us to connect and manage the device remotely, including debug and updates. Based on this second feature we can evaluate the reason of eventual disconnection.

5. Modem and SIM Countries Coverage

The following table displays the Countries coverage of the Teltonika routes included into DAE M2M Kit so far. Also note that the most popular one provided by DAE is the device with product code **RUT240*6****.

It could rarely happen the some other are provided or have been provided, but they operate at least on the same frequencies/bands covered by the most common model.

Product code	Region (operator)	Frequency
RUT240 *6**	Europe, the Middle East, Africa, Korea, Thailand	• 4G (LTE-FDD): B1, B3, B7, B8, B20, B28A • 3G: B1, B8 • 2G: B3, B8
RUT240 *0**	Europe, the Middle East, Africa, Korea, Thailand, India	• 4G (LTE-FDD): B1, B3, B5, B7, B8, B20 • 4G (LTE-TDD): B38, B40, B41 • 3G: B1, B5, B8 • 2G: B3, B8
RUT240 *0*00G	Europe, the Middle East, Africa, Korea, Thailand, India (Vodafone)	• 4G (LTE-FDD): B1, B3, B5, B7, B8, B20 • 4G (LTE-TDD): B38, B40, B41 • 3G: B1, B5, B8 • 2G: B3, B8

6. M2M SIM Coverage and bundle

Hereafter a table which reports countries covered by TiSparkle and previous Vodafone agreement is shown:

Country	Vodafone Network used	TiSparke Network used
Austria	• Mobilkom	• Connect Austria • T-Mobile Austria
Belgium	• Proximus	• Orange Belgium Nv/Sa • Belgacom
Bulgaria	• M-Tel	• Globul • Vivacom
Croatia	• VIPnet	• Croatian Telec. - Ht • Tele2
Cyprus	• Cytamobile-Vodafone	• Cytamobile-Vodafone • Areeba
Czech Republic	• Vodafone	• Telefonica • T-Mobile Czech
Denmark	• TDC	• Sonofon • Telia Denmark
Estonia	• Elisa	• Eesti Mobil Telefon • Tele2 Eesti Aktiasel • Elisa As
Finland	• Elisa	• Dna • Elisa Ltd • Sonera Mobile Ntw
France	• SFR	• Orange France • Bouygues Telecom
Germany	• Vodafone	• Telekom Deutschland • O2 Germania

Greece	• Vodafone	• Dcs 1800 Cosmote • Wind Hellas
Hungary	• Vodafone	• Telenor Zrt • T-Mobile
Ireland	• Vodafone	• Hutchison 3g • Meteor Mobile Comm.
Italy	• Vodafone	• Telecom
Latvia	• Bite Latvija	• Tele2 Ltd • Latvian Mobile Telep
Liechtenstein	• Swisscom	• Gsm 1800 Mobilkom Ag
Lithuania	• Bite GSM	• Uab Bite Lietuva • Omnitel
Luxembourg	• Tango	• Tango • Orange Comm. S.A.
Malta	• Vodafone	• Mobisle Communic. • Melita Mobile
Netherlands	• Vodafone	• T-Mobile Bv • Kpn Olanda
Norway	• Telenor	• Telia Sonera Sa • Telenor Mobil
Poland	• Plus	• T-Mobile • Orange Polonia
Portugal	• Vodafone	• Nos • Tmn
Romania	• Vodafone	• S.C. Cosmote S.A. • Orange Romania
Slovenia	• SI Mobil	• Mobitel Slovenia • Telemach Mobil D.O.O

Spain	• Vodafone	• Orange Spagna • Telefonica Moviles
Sweden	• Telenor	• Telenor Sverige Ab • Tele 2 Comviq • Teliasonera
Swiss	*N/A*	• Salt (ex Orange) • Swisscom Mobile • TDC Switzerland AG
United Kingdom	• Vodafone	• O2 Uk • Hutchis. 3g Uk - H3g • T-Mobile Uk

7. M2M Connection requirements

Daikin On Site require at least a stable 3G HDSPA connection to be operative. Any other kind of lower connection, like 3G-UMTS or 2G, will result in a “connected” indication on DoS, but the bandwidth will be not enough to share and store data correctly or use DoS service.

What we strongly suggest, whether intention to keep Modem/SIM of the current operator subsist, is to check in advance the actual 3G/4G signal level and coverage in the area where the router will be installed, prior to the commissioning of the plant (or even order).

Sometimes can be helpful to use services such as the following for a preliminary evaluation of the signal coverage:

- https://www.nperf.com/
- https://www.opensignal.com/networks

Anyway, there are many others that may be more specific for a preliminary assessment. This obviously cannot be a substitute for a detection test of the on-site signal strength, but only an aid.

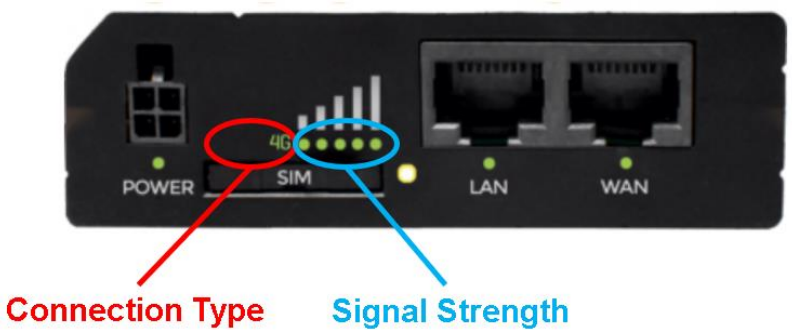
7.1. Signal Strength and connection stability

With reference to the following table for GMS signals:

Case	Signal Strength	Indicators (on a scale of 5 divisions)	Quality of connection
1	from -121 to -107 dBm	0-1 Signal notches	Very low reception
2	from -107 to -98 dBm	1-2 Signal notches	Low reception
3	from -98 to -87 dBm	2-3 Signal notches	Good reception
4	from -87 to -76 dBm	3-4 Signal notches	Very good reception
5	from -76 dBm onwards	4-5 Signal notches	Excellent reception

A steady connection for DoS requirements means at least 3/5 Mb/s speed not fluctuating (i.e., meanwhile tests are proceeded, if downloading speed is going from 1 Mb/s to 10 Mb/s that is not good even if average is 5 Mb/s). In other words, it is necessary to be in the table 3 – 5 connection cases with at least 3G-HSDPA for at least 99 % of the time. Anyhow, a 4G connection is always preferable since the highest stability of signal and the greater data bandwidth available.

Referring to the RUT240, the current operative state regarding the connection type (4G, 3G or 2G) and the signal strength can be observed by means of dedicate LEDs on the SIM tray side.



NOTE: remember that to maximize the signal reception the external antenna must be installed externally to the operator panel cabinet. Refer to Importance of installation of an external antenna paragraph for more details.

8. DAE M2M device with a third part mobile operator

If customer want to purchase a M2M DAE device to use a third part SIM, it is necessary to provide for a schedule before they are shipped from the factory.

In the case customer wish to use a third part SIM on a device already operating on the field, i.e., replace it with third-party operator, it is necessary to perform a specific procedure, different for the Vodafone Machinelink 3G modem and the Teltonika RUT240 router.

Please also note that the device is able to be auto-configure itself to operate with almost all European mobile operators thanks to an internal DB including all needed info (i.e. APN).

8.1. Unblock Vodafone Machinelink 3G Modem

1. Make sure that the old Vodafone SIM card is inserted, and the device is communicating with the mobile network. If the modem cannot communicate via mobile network this procedure cannot be completed.
2. Supply power to the modem.
3. Send the IMEI/ICCID code pairs via email to Daikin on Site – Smart Center. An SMS including unpairing command will be sent to the modem.
4. Wait for Daikin on Site – Smart Center email confirmation.
5. Extract the Vodafone SIM (see paragraph Removing the SIM card and reading the ICCID and IMEI code) and insert the new one.
6. Restart the modem.

8.2. Unblock Teltonika RUT240

It is required a proprietary DAE software for reprogramming these devices to be used with third part SIM.

In the future the software will be provided to our Affiliates. For the moment, customer must instead ensure that the M2M device is shipped from the DAE factory already programmed to be used with any 3rd-part mobile operator.

8.3. Removing the SIM card and reading the ICCID and IMEI code

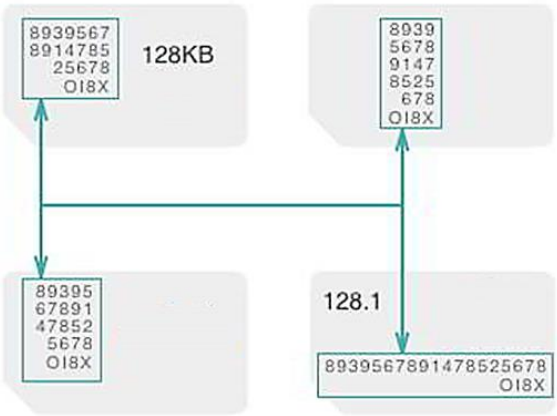
There are two cases where the SIM removal may be necessary:

- Find the ICCID code, usually written on the back of the SIM.
- Replacement of the original SIM and / or insertion of a third-party SIM.

NOTE: if customer want to use a third-party SIM by replacing a SIM DAE (Vodafone and TIM), refer to paragraph DAE M2M device with a third part mobile operator for the procedure.

In order to remove the SIM, it is sufficient to extract the SIM door by pressing (moderately) the small button in the hole immediately near to it via a sharp object or by using the tool indicated with "4" in the list on the kit components Router Teltonika RUT240 at paragraph DAE M2M Router kit:

The ICCID code is usually printed on the back of the SIM itself:



Other information relating to the device, such as its **IMEI code**, Serial and the Product Code, are indicated on the label stuck on the back of the router itself:

NOTE: WIFI SSID and PASSWORD reported on the same label are no more valid or usable since the customization of the devices with DAE software.

9. DAE M2M devices connection problem

In this section are reported some inspections and the most common issues related to M2M devices (missing of) connection.

9.1. Preliminary checks before contacting Daikin on Site – Smart Center

Normally almost all the lack connection are caused by:

- Bad mobile network signal reception on site.
- Device not properly power supplied, connected or external antenna not connected.
- A wrong connection with or configuration of the MTIII/MT4 controller.

Before to proceed with a support request, please perform the following checks:

1. Connection status of M2M device by means of front LEDs.
2. Cable connection of the M2M device with power supply, controller and antennas.
3. Controller MTIII/MTIV configuration.
4. SIM is correctly inserted in its tray.
5. M2M device installing position is covered by a good 3G/4G signal for the chosen mobile operator.

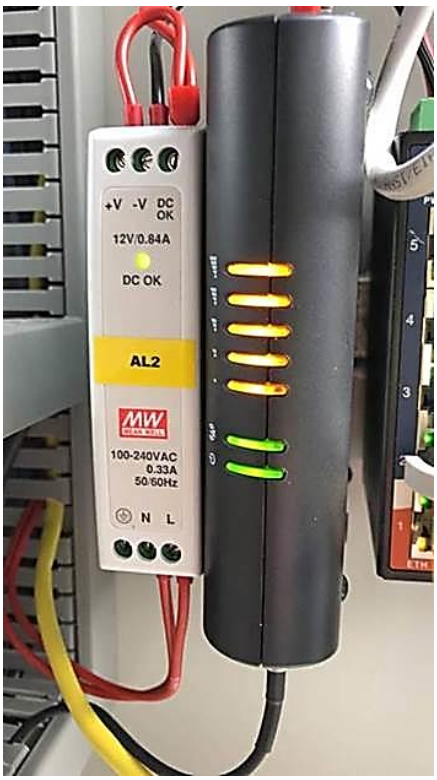
Based on our experience, very rarely a connection problem is due to a cause different from those above, in a wrong configuration of the M2M or in a device failure.

9.2. Vodafone Machinelink - 2G connection know issue

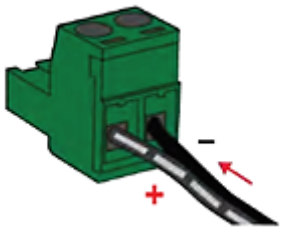
A modem 2G connection is a too poor connection for Daikin on Site needs. Looking at following schema, on “Mobile Signal Strength" section, is visible that “yellow” is not a good value, even if all LEDs are turned on.

Overview of LED indicators

LED ICON	LED	COLOUR	STATE	DESCRIPTION
	Power		Off	Power off
			Double flash	Powering up
			On	Power on
			On	Power on in recovery mode
			Slow flashing	Hardware error
	Network		On	Connected via WWAN
			Blinking	Traffic via WWAN
			Slow flashing	Connecting PDP
			On	Registered network
			Slow flashing	Registering network
			Slow flashing	SIM PIN locked
			Fast flashing	SIM PUK locked
			On	Can't connect
	Mobile signal strength		On	3G
			On	2G GPRS
			On	GSM only (no GPRS)



In some cases, it could be temporary solved by a **restart the modem** (by disconnecting and reconnecting its own power supply connector.



Also make sure that the **magnetic base antenna is connected to the modem and placed outside of the electric panel of the unit**, otherwise the signal will always be weak.

We should have at least some green “Mobile signal” notch lit on and cross fingers for a 3G-HDSPA signal.

9.3. Request for support and necessary data

Please note that Daikin on Site – Smart Center can only support request for DAE M2M devices that use DAE SIM (TiSparkle or Vodafone)**.**

To require assistance of Daikin on Site – Smart Center the following information are necessary to allow the team to provide support:

1. The official name of the plant or the Activation Key
2. IMEI code of the DAE Modem or Router
3. ICCID code of the DAE Tisparkle or Vodafone SIM
4. A (clear) photo of the led side of the RUT240
5. A photo of the **IP Config** submenu of the MTIII/IV controller HMI
6. A photo of the ***Daikin on Site*** submenu of the MTIII/IV controller HMI

Please note that all requested info is necessary for a correct diagnosis of possible connection issues. We will verify the status of the device connection and will support customer as soon as possible.

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