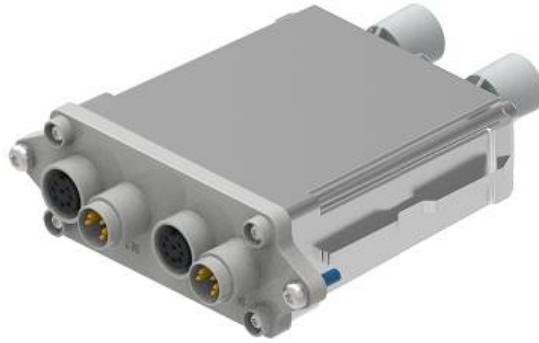


Multi Internal Remote Control Unit (MIRCU) User Manual

Document Version 1.4



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1 Foreword

This user manual describes the basic use of electrical tilt antenna connected to the Multi Internal Remote Control unit (MIRCU). Due to different equipment and software upgrade, some description in this manual may differ from the actual use. Information contained in this document is subjected to change without prior notice.

2 Safety Precaution

- Install safety sign onsite to let public know that area is dangerous for public; operating personnel must use Protection Equipment during work.
- Pay attention for any high Voltage cable around during installation, be careful and avoid electrical shock.
- Make sure Antenna installed in protection angle of the tower Lightning rod.
- Grounding Cable must be installed, make sure the grounding resistance lesser than 5Ω.

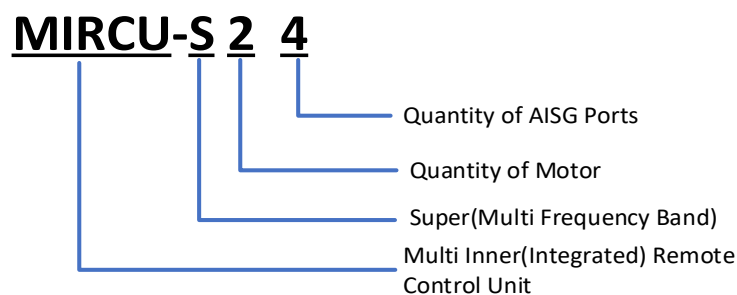
3 Overview

3.1 Main Purpose & Scope of Application

MIRCU is a controller for electrical tilt enabled antenna to perform remote electrical tilting.

It meets AISG2.0 & AISG3.0 standards, suitable to be use with all Ericsson, Nokia, Huawei, and ZTE AISG2.0 & AISG3.0 Base Station.

3.2 Model Description



3.3 Normal Working Conditions and Environment

- Ambient temperature: -40 °C to +60 °C
- Power supply: DC +10 V to +30 V

3.4 Dimension & Weight

MIRCU outline drawing is shown in Figure 1 below:

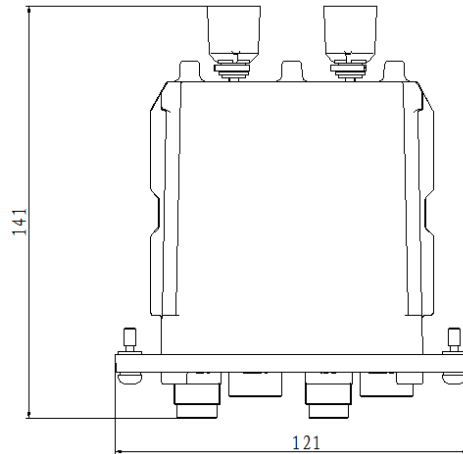


Figure 1 IRCU Outline

Size and weight are shown in Table 1 below:

Model	Dimensions (L × W × H)/mm	Weight/kg (Approximate)	Package Size (L × W × H)/mm
MIRCU-S24	141x125x41	0.5	160×178×87

Table 1 IRCU Dimensions and Weight

4 MIRCU Specification

For MIRCU specification please refer to MIRCU Datasheet.

MIRCU tilting angle with adjustment accuracy of $\pm 0.1^\circ$.

5 RET System and Working Principle

5.1 RET System

Multi Remote Electrical Tilt (RET) system consists of 2 major part, electrical tilt enabled antenna and controller.

5.2 Working Principle

MIRCU obtains control information or number of motor rotation pulse throughout calibration. By adjusting the motor rotation of MIRCU, it is able to gain movement control of the phase

shifter in an antenna, and thus able to control antenna electrical tilt angle. While maintaining real time communication between

MIRCU and PCU (Portable Control Unit), PCU send control command to MIRCU; MIRCU will return the control result to PCU, and PCU act as Human-Machines interface.

5.3 2 Primaries Working Principle

The MIRCU-S24 module has 2 pairs of AISG ports and supports AISG3.0 protocol, and can be controlled by 2 primaries (Base Stations) which meet AISG2.0 or AISG3.0 protocol at the same time. The AISG ports of the module share the same configuration information and have the same serial number.

There are 2 motors inside MIRCU-S24, which can drive 8-frequency antenna currently. In near future, with the increase complexity of antenna demand, the firmware will be updated to supported up to 20-frequency antenna, expected to be done by Q2 2021.

The 2 pairs of AISG ports have no difference on function but authority. Any band can be assigned by AISG port no matter AISG 1 or 2, provided the band is not yet configured by another AISG port.

The device serial numbers that can be read by AISG2.0 base station by scanning the MIRCU-S24 module are as follows: (default access permission)

Serial Number	Address	Device Type	AISG
08CB20C1234567-R4	01	CB	RET (0x01)
04CB20C1234567-Y4	02	CB	RET (0x01)
06CB20C1234567-R2	03	CB	RET (0x01)
02CB20C1234567-Y2	04	CB	RET (0x01)
05CB20C1234567-R1	05	CB	RET (0x01)
01CB20C1234567-Y1	06	CB	RET (0x01)
07CB20C1234567-R3	07	CB	RET (0x01)
03CB20C1234567-Y3	08	CB	RET (0x01)

When the device access permission for the port is shown as “No Access”, the AISG2.0 base station will not be able to scan the device. The access permission of the port is set by MALD configuration command as defined in AISG3.0 protocol.

For example, the module has 8 devices and the device access permissions are set as below:

RET	PROT1	PORT2
CB 01CB20C1234567-Y1	Read & Write	No Access
CB 02CB20C1234567-Y2	Read & Write	No Access
CB 03CB20C1234567-Y3	Read & Write	No Access
CB 04CB20C1234567-Y4	Read & Write	No Access
CB 05CB20C1234567-R1	No Access	Read & Write
CB 06CB20C1234567-R2	No Access	Read & Write
CB 07CB20C1234567-R3	No Access	Read & Write
CB 08CB20C1234567-R4	No Access	Read & Write

When the AISG2.0 base station is connected, port 1 can scan to CB01CB20C1234567-Y1, CB02CB20C1234567-Y2, CB03CB20C1234567-Y3, CB04CB20C1234567-Y4, 4 devices. Port 2 can scan to CB05CB20C1234567-R1, CB06CB20C1234567-R2, CB07CB20C1234567-R3, CB08CB20C1234567-R4, 4 devices.

The device serial numbers that can be read by the AISG3.0 base station by scanning the MIRCU-S24 module are as below:

Serial No	Address	Vendor	DevType	AISG Version
CB00000CB20C1234567	01	CB	MALD	3.0.0

5.3.1 Operation in AISG2.0 Mode

A summary of operation conflict for 2 primaries (1st & 2nd Primary) operating MIRCU-S24 is shown in table below:

****Note:** All “√” and “X” shown are mainly in connection to the 2nd primary, which implies whether or not the corresponding action (listed horizontally in table) can be performed on the 2nd primary when the 1st primary is executing a certain command or action (listed vertically in table). The order of priority of the “primary” is not fix and it is depending on which primary actually starts an action 1st.

1 st Primary \ 2 nd Primary	Scan	Calibration	Set Tilt	L2 Restoration	L7 Restoration	Update Config file	Update Firmware	Information	Set Device Data	Self-test
Scan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calibration	✓	X	X	✓	✓	X	X	✓	✓	✓
Set Tilt	✓	X	X	✓	✓	X	X	✓	✓	✓
L2 Restoration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L7 Restoration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Update Config file	X	X	X	X	X	X	X	X	X	X
Update Firmware	X	X	X	X	X	X	X	X	X	X
Information	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Set Device Data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Self-test	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

X: **Note 1)** MIRCU cannot operate the commands from 2 respective primaries simultaneously. It conflicts each other and doesn't comply with AISG standard.

Note 2) 1 primary can operate the command successfully, but the command sent by another primary failed to achieve.

✓ : **Note 1)** MIRCU-S24 can operate the commands from 2 respective primaries simultaneously, and comply with AISG standard.

Note 2) Although 'Update Config File' and 'Update Firmware' can run on 2nd primary while 1st primary is performing an action, the link on 1st primary will break then and all actions will stop and fail to operate.

a) Scan

MIRCU-S24 supports 2 primaries to scan MIRCU simultaneously. When 1st primary is scanning, the 2nd primary is able to scan, calibrate, set tilt, restore L2/L7, update configuration file, update firmware, get MIRCU information, set device data and self-test.

When 1st primary is scanning, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Support	No Impact
Set Tilt	Support	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Support	Broken Link
Update Firmware	Support	Broken Link
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

b) Calibration

MIRCU-S24 does NOT support 2 primaries to perform calibration simultaneously.

When 1st primary is calibrating, the 2nd primary is able to scan MIRCU, restore L2/L7, get MIRCU information, set device data and self-testing but NOT able to calibrate, set tilt, update configuration file and update firmware.

When 1st primary is calibrating, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Reply "Busy"	No Impact
Set Tilt	Reply "Busy"	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Reply "Busy"	No Impact
Update Firmware	Reply "Busy"	No Impact
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

c) Set Tilt

MIRCU-S24 does NOT support 2 primaries to set tilt simultaneously. When 1st primary is setting tilt, the 2nd primary is able to scan MIRCU, restore L2/L7, get MIRCU information, set device data and self-testing but NOT able to calibrate, set tilt, update configuration file and update firmware.

When 1st primary is setting tilt, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Reply "Busy"	No Impact
Set Tilt	Reply "Busy"	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Reply "Busy"	No Impact
Update Firmware	Reply "Busy"	No Impact
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

d) L2 /L7 Restoration

MIRCU-S24 supports 2 primaries to restore L2 or L7 simultaneously. It will not cause hardware reset of the entire module. When 1st primary is restoring L2/L7, the 2nd primary is able to scan, calibrate, set tilt, restore L2/L7, update configuration file, update firmware, get MIRCU information, set device data and self-test.

e) Upload Configuration File

MIRCU-S24 does NOT support 2 primaries to update configuration file simultaneously. When 1st primary is updating configuration file, the 2nd primary can NOT perform any operation. It will reset and the link will be disconnected.

f) Update Firmware

MIRCU-S24 does NOT support 2 primaries to update firmware simultaneously. When 1st primary is updating firmware, the 2nd primary can NOT perform any operation. It will reset and the link will be disconnected.

g) Getting MIRCU Information

MIRCU-S24 supports 2 primaries to get RET information simultaneously. When 1st primary is getting MIRCU information, the 2nd primary is able to scan, calibrate, set tilt, restore L2/L7, update configuration file, update firmware, get MIRCU information, set device data and self-test.

When 1st primary is setting tilt, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Support	No Impact
Set Tilt	Support	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Support	Broken Link
Update Firmware	Support	Broken Link
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

h) Set Device Data

MIRCU-S24 supports 2 primaries to set device data simultaneously. When 1st primary is setting device data, the 2nd primary is able to scan, calibrate, set tilt, restore L2/L7, update configuration file, update firmware, get MIRCU information, set device data and self-test.

****Note:** The data that can be changed include Installation date, Installer's ID, Base station ID, Sector ID, Antenna bearing (degrees), Installed mechanical tilt (degrees) and Antenna serial number. Antenna model number, Antenna operating band(s), Beamwidth, Gain (dB), Maximum tilt (degrees) and Minimum tilt (degrees) can NOT be changed, MIRCU-S24 will reply “**Ready Only**”.

When 1st primary is setting device data, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Support	No Impact
Set Tilt	Support	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Support	Broken Link
Update Firmware	Support	Broken Link
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

i) Self-test

MIRCU-S24 supports 2 primaries to perform self-testing simultaneously. When 1st primary is performing self-testing, the 2nd primary is able to scan, calibrate, set tilt, restore L2/L7, update configuration file, update firmware, get MIRCU information, set device data and self-test.

When 1st primary is performing self-testing, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Support	No Impact
Set Tilt	Support	No Impact
L2 /L7 Restoration	Support	No Impact
Update Configuration File	Support	Broken Link
Update Firmware	Support	Broken Link
Get Information	Support	No Impact
Set Device Data	Support	No Impact
Self-test	Support	No Impact

5.3.2 Operation in AISG3.0 Mode

A summary of operation conflict for 2 primaries (1st & 2nd Primary) operating MIRCU-S24 is shown in table below:

****Note:** All “√” and “X” shown are mainly in connection to the 2nd primary, which implies whether or not the corresponding action (listed horizontally in table) can be performed on the 2nd primary when the 1st primary is executing a certain command or action (listed vertically in table). The order of priority of the “primary” is not fix and it is depending on which primary actually starts an action 1st.

2 nd Primary \ 1 st Primary	Scan	Calibration	Set Tilt	Reset Port	Reset ALD	Upload	Download	MALD Configure	Ping
Scan	√	√	√	√	√	√	√	√	√
Calibration	√	X	X	√	√	X	X	X	X
Set Tilt	√	X	X	√	√	X	X	X	X
ResetPort	√	√	√	√	√	√	√	√	√
ResetALD	X	X	X	X	X	X	X	X	X
Upload	√	X	X	√	√	X	X	X	X
Download	X	X	X	X	X	X	X	X	X
MALD Configure	√	X	X	√	√	X	X	X	X
Ping	√	X	X	√	√	X	X	X	X

X: Note 1) MIRCU cannot operate the commands from 2 respective primaries simultaneously. It conflicts each other and doesn't comply with AISG standard.

Note 2) 1 primary can operate the command successfully, but the command sent by another primary failed to achieve.

✓: **Note 1)** MIRCU-S24 can operate the commands from 2 respective primaries simultaneously, and comply with AISG standard.

Note 2) When "RESETALD" is run on 2nd primary when 1st primary is performing an action, all the action on the 1st primary will be suspended.

a) Scan

MIRCU-S24 supports 2 primaries to scan MIRCU simultaneously. When 1st primary is scanning, operation on 2nd primary is not affected and it is able to scan, calibrate, set tilt, reset port, reset ALD, upload/download file, configure MALD and ping.

When 1st primary is scanning, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Support	No Impact
Set Tilt	Support	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Support	No Impact
Download File	Support	Broken Link
MALD Configure	Support	No Impact
PING	Support	No Impact

b) Calibrate

MIRCU-S24 does NOT support 2 primaries to perform calibration simultaneously.

When 1st primary is calibrating, the 2nd primary is able to scan, reset port, reset ALD but NOT able to calibrate, set tilt, upload/download file, configure MALD and ping.

When 1st primary is calibrating, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Return "UseByAnotherPort"	No Impact
Set Tilt	Return "UseByAnotherPort"	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Return "UseByAnotherPort"	No Impact
Download File	Return "UseByAnotherPort"	No Impact
MALD Configure	Return "UseByAnotherPort"	No Impact
PING	Return "UseByAnotherPort"	No Impact

c) SetTilt

MIRCU-S24 does NOT support 2 primaries to set tilt simultaneously. When 1st primary is setting tilt, the 2nd primary is able to scan, reset port, reset ALD but NOT able to calibrate, set tilt, upload/download file, configure MALD and ping.

When 1st primary is setting tilt, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Return "UseByAnotherPort"	No Impact
Set Tilt	Return "UseByAnotherPort"	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Return "UseByAnotherPort"	No Impact
Download File	Return "UseByAnotherPort"	No Impact
MALD Configure	Return "UseByAnotherPort"	No Impact
PING	Return "UseByAnotherPort"	No Impact

d) Reset

AISG3.0 has 2 kind of reset operations: **ResetPort** and **ResetALD**. ResetPort only resets the pair of port connecting to the 1st OR 2nd primary and does NOT affect the operation of another primary. ResetALD resets the whole module and it will restart, both primaries will hence be disconnected.

e) Upload (Fetch File from Module)

The upload command starts with 'UploadStart' and ends with 'UploadEnd'. The file is carried and uploaded by using 'UploadFile' command. The supported file types are FirmwareFile and ConfigureFile. The module does not support multi-ports file upload operation simultaneously, which mean when 1st primary is performing upload, the 2nd primary will be in '**Restricted Connection State**'.

When 1st primary is uploading file, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Return "IncorrectState"	No Impact
Set Tilt	Return "IncorrectState"	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Return "IncorrectState"	No Impact
Download File	Return "IncorrectState"	No Impact
MALD Configure	Return "IncorrectState"	No Impact
PING	Return "IncorrectState"	No Impact

f) Download (Download file to Module)

The file download command starts with 'DownloadStart' and ends with 'DownloadEnd'. The file is carried and downloaded by using 'DownloadFile' command. The supported file types are FirmwareFile and ConfigureFile. The module does not support multi-ports file download operation simultaneously, which mean when 1st primary is performing download, the 2nd primary ports will be close and no operation can be performed.

g) MALD Configure

When MALD configuration is performed on the module, the access authority of the module port to each of the subunit of the antenna can be configured. When MALD configuration operation is performed on the 1st primary, the 2nd primary will be in '**Restricted Connection State**'.

When 1st primary is configuring MALD, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Return "IncorrectState"	No Impact
Set Tilt	Return "IncorrectState"	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Return "IncorrectState"	No Impact
Download File	Return "IncorrectState"	No Impact
MALD Configure	Return "IncorrectState"	No Impact
PING	Return "IncorrectState"	No Impact

h) Ping

When 1st primary is performing PING operation, the 2nd primary will be in '**Restricted Connection State**'. Please refer to AISG3.0 protocol for details PING operation.

When 1st primary is performing ping, if 2nd primary send command to MIRCU, the impact on the 1st primary is shown in table below:

2 nd Primary Action	If MIRCU Support	Impact on 1 st Primary
Scan	Support	No Impact
Calibration	Return "IncorrectState"	No Impact
Set Tilt	Return "IncorrectState"	No Impact
ResetPort	Support	No Impact
ResetALD	Support	Broken Link
Upload File	Return "IncorrectState"	No Impact
Download File	Return "IncorrectState"	No Impact
MALD Configure	Return "IncorrectState"	No Impact
PING	Return "IncorrectState"	No Impact

6 MIRCU Installation and Connection

6.1 Installation Requirement

6.1.1 Control Cable Requirement

- Control Cable connector:
Meet the requirements of IEC60130-9 8-pin connector. End of cable are composition of Male and Female Connectors, connector and cable core meet the AISG interface standard requirements.
- Cable:
Composition of 5 core with metal and plastic protective layer shielding cable, core diameter requirements: $3 \times 0.75\text{mm} + 2 \times 0.32\text{mm}$.
- Protection class:
IP65

6.1.2 Power Supply

MIRCU Input Power: DC +10 V ~ +30 V

6.1.3 Installation Tools

32mm open-end Torque wrench x 1.

6.2 MIRCU-S24 Installation

6.2.1 MIRCU-S24 Installation Steps and Methods

- a) As shown in Figure 2, "AISG OUT" logo on Antenna cover need to be aligned with MIRCU "IN" and "OUT", then insert MIRCU into antenna mounting slot.

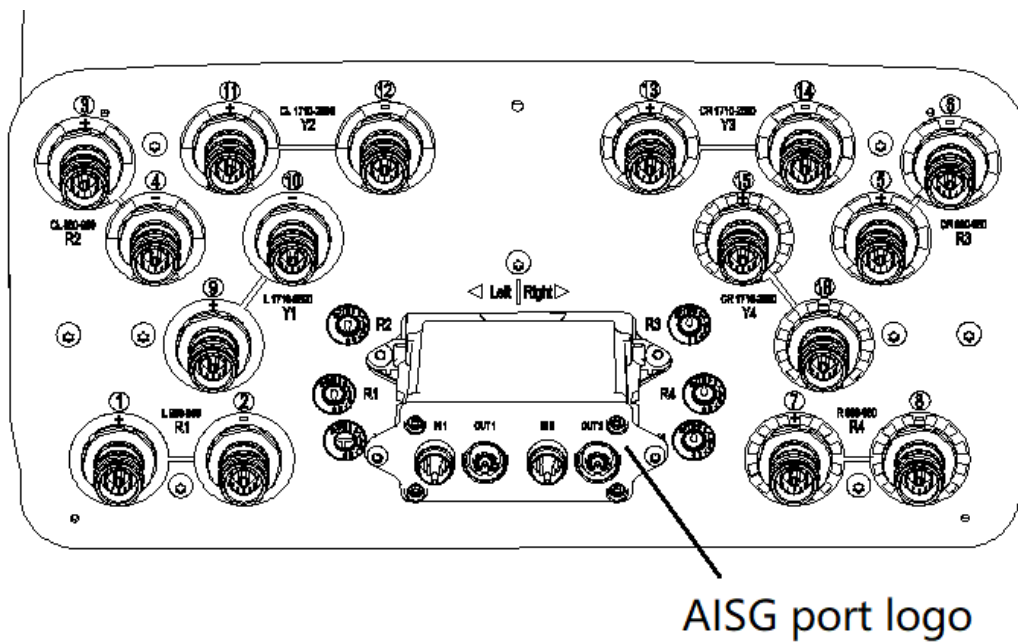


Figure 2 MIRCU Alignment

- b) As shown in Figure 3, tighten screws on MIRCU using a slotted type screwdriver.

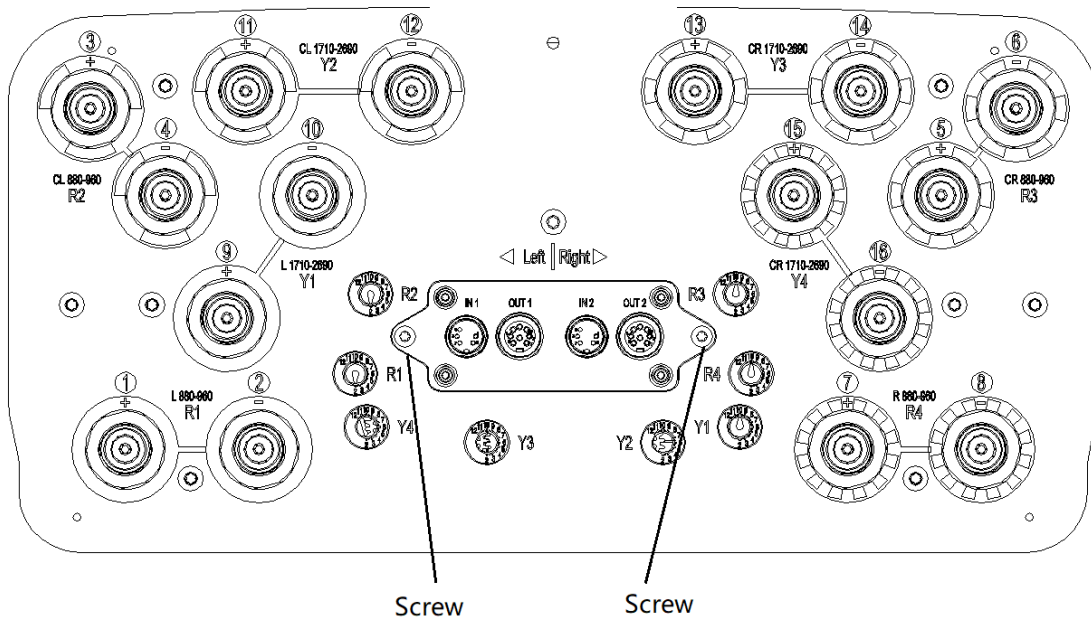


Figure 3 MIRCU Installation

- c) As shown in Figure 4, connect the control cable to the AISG Connector locate at the lower part of the MIRCU and tighten the connector.

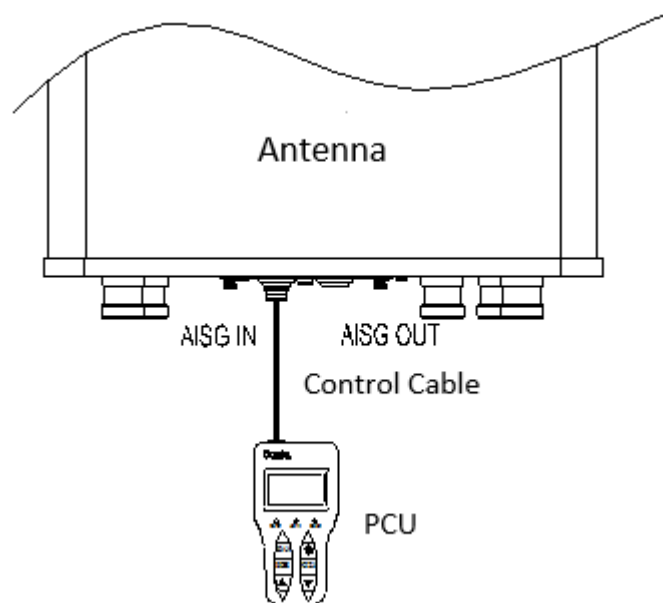


Figure 4 AISG Control Cable to PCU

- d) If there is more than one MIRCU need to be connect, daisy-chained cascade method can be used as show in Figure 5.

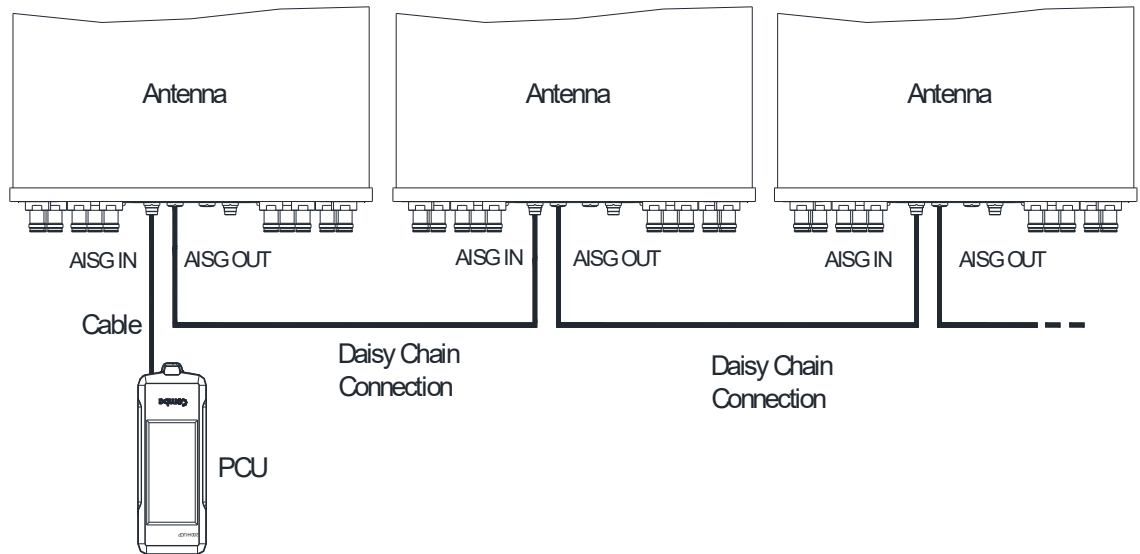


Figure 5 Multiple MIRCU Daisy-Chain Cascade Schematic Diagram

****Note:** The control cables and MIRCU connectors at both ends were Male and Female connector. MIRCU male connector used to receive Input Signal and connect with female connector of control cables; MIRCU female connector used to transmit output signal and cascade in series to another MIRCU using male cable connector. Control cables from PCU only can be connect to the male connector of MIRCU.

- e) Water proof: Firstly, wrap 3 layers of waterproof tape, then wrap 3 layers of insulating tape, fastened with cable ties at both ends.

6.2.2 Connection between MIRCU, PCU and Antenna System

Connection between MIRCU, PCU and antenna system connections are shown in Figure 6. There are 3 connections, namely:

Figure 6(a): MIRCU directly connected with the PCU via the control cable;

Figure 6(b): MIRCU connected with antenna system terminal SBT (Smart Bias-T), PCU and the base station apparatus connected to the end of SBT, the control signal transmitted thru the RF feeder.

Figure 6(c): MIRCU connected with AISG interface enable TMA, PCU and the base station apparatus connected to the end of SBT, the control signal transmitted thru the RF feeder.

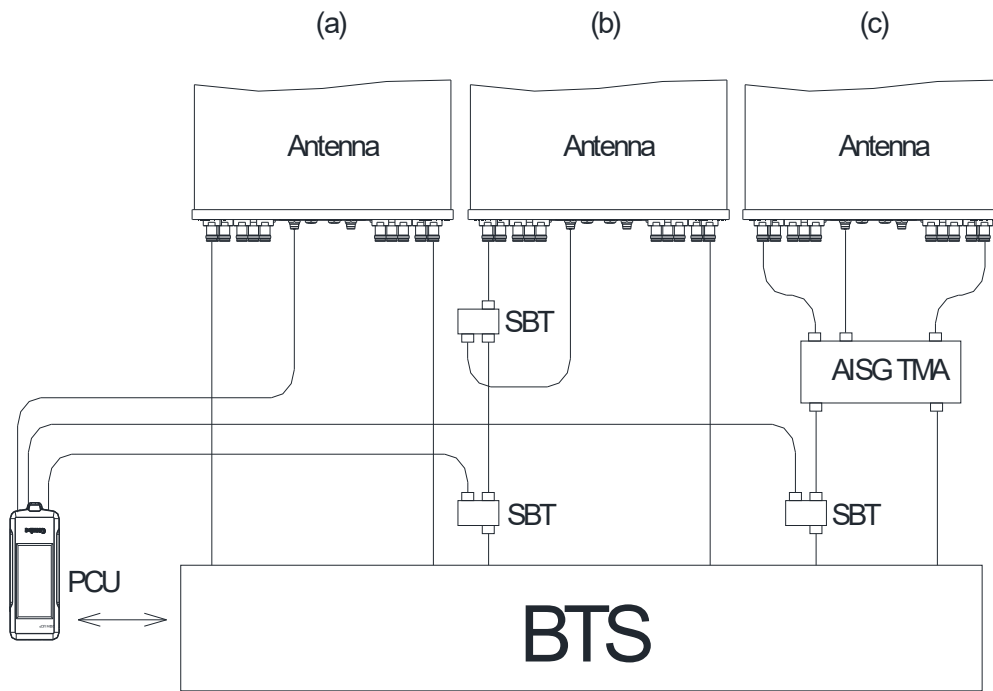


Figure 6 MIRCU, PCU and Antenna System Connection Diagram

6.3 Mapping of MIRCU to Phase Shifter

Comba existing MIRCU can satisfy 1 to 8 RET phase shifter control, and will be upgraded to support up to 20 phase shifter control in near future through firmware upgrade, expected to be done by Q2 2021. All control and driver chip are integrated into a single MIRCU module. The relative specifications are as shown in Table 2.

Product \ Parameter	No. of Motor Driving Control Unit	Suitable RET Antenna	Installation Manner
MIRCU-S24	2	1 to 8 freq band build-in RCU RET Antenna. Upgradable to 20 freq band in future.	Plug and play

Table 2 MIRCU in relation to Antenna Suitability

Comba MIRCU product, as shown in Figure 7 and Figure 8, employ the usage of socket, so as to realize the plug-and-play function whereby the MIRCU can be easily installed or uninstalled. It greatly enhances the reliability of the product in term of connection and utilization. Also, the maintenance is greatly simplified.

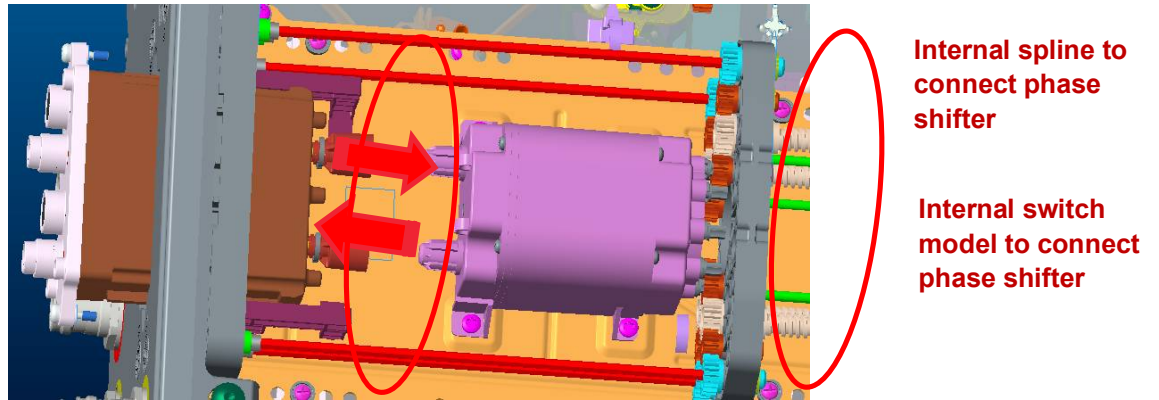


Figure 7 MIRCU-S24 Plug-and-play Installation

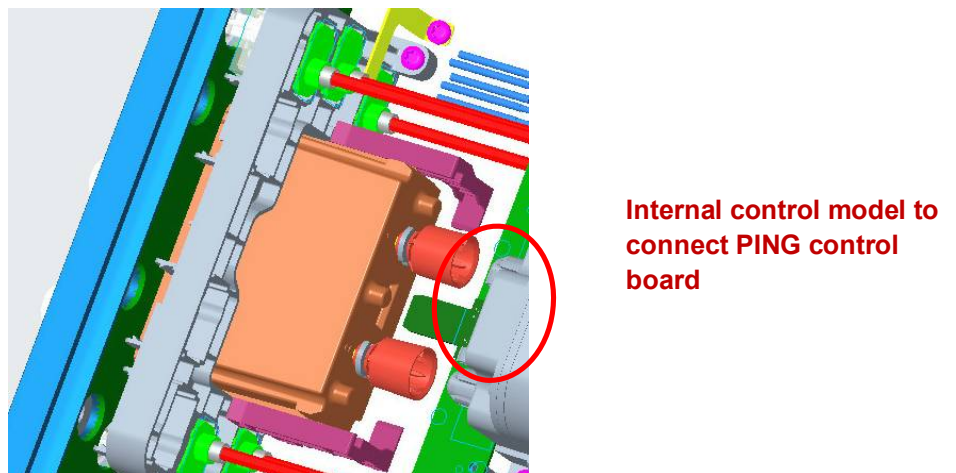


Figure 8 MIRCU-S24 Ping Selection board Plug-and-play Installation

Each Driver Unit/Motor comes with their own serial number. For Figure 9 below, 8 set of serial numbers will be displayed on PCU when connected.

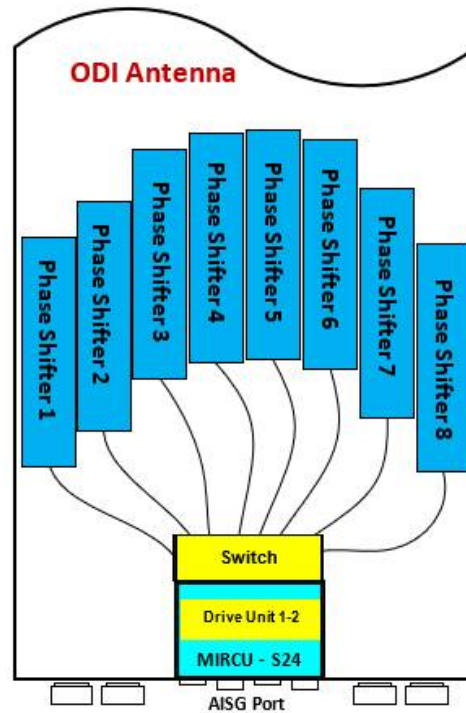


Figure 9 Mapping of MIRCUS24 to Phase Shifter

6.4 MIRCU Control Cable, Lightning Protection and Grounding cables

6.4.1 Control cable, Lightning Protection and Grounding requirements

MIRCU control cable can connect through SBT or TMA (as shown in Figure 6 (b), (c)), normally control cable will be short and not more than 2m, lightning protection and grounding will be implemented along the RF feeder and hence it is not necessary for control cable to carry out lightning Protection and grounding again.

However, if MIRCU and control cable are connected as Figure 6 (a), whereby control cable connect to RCU directly, then it is necessary for the cable control to proceed with Lightning Protection and Ground requirement. Details as follows:

- a) Control cables that connect to base station antenna should be within the scope of protection of the air terminals. Air terminals shall establish special lightning current deflectors, materials suitable are 4mm x 40 mm galvanized flat steel.
- b) Control cables metal sheath should be clamp to grounding kit within 1m of antenna, 1m within the cable tray at the bottom of the tower, and 1m before entering base station shelter. Make sure grounding cable is installed property, feeder window of the shelter room should be close to the ground and properly connect to the grounding bar that leads to the ground. (See Figure 10)

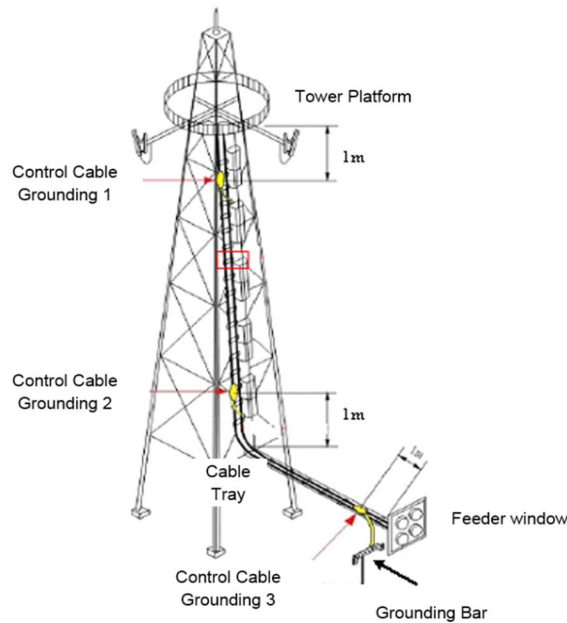


Figure 10

- c) Control cables metal sheath attach to grounding kit as shown in Figure 11.

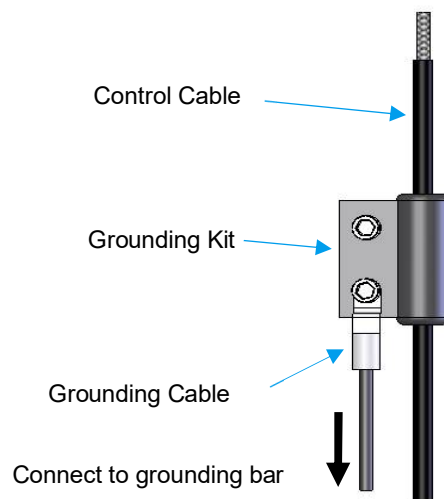


Figure 11

6.4.2 Grounding Kit Installation Procedure

- Prepare ground kit, as shown in Figure 12 1a.
- Clean the plastic sheath of the control cables, cutting plastic sheath with a suitable stripper tool, expose metal braid sheath of control cable, with length about 22mm, as shown in the Figure 12 1b.
- Remove the protection sheet on the ground kit, clamping the grounding kit around the control cable, and align with striped line as shown in Figure 13

- d) Tighten the screws of the grounding kit, as show in Figure 14.
- e) Connect and tighten grounding cable on the grounding bar which locate at bottom of the tower.

****Note:** The control cables should be in upright position while clamping with grounding kit.

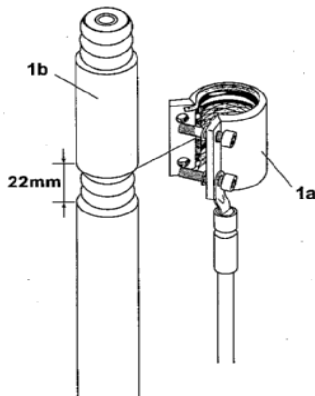


Figure 12

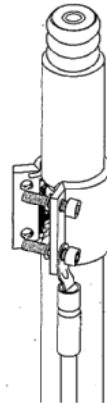


Figure 13

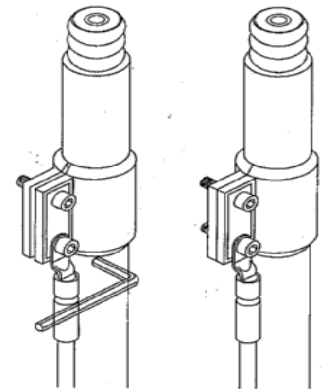


Figure 14

7 Transportation and Storage

7.1 Transportation

Equipment can be carriage by car, train, ship, airplane or other transportation vehicles. Do prevent rain, avoid excessive vibration and impact during the transportation. Handle with care while loading and unloading, strictly avoid dropping from high and other rough handling.

7.2 Storage

Packaged equipment should be placed in dry and ventilated area, ambient air without acidic, alkaline and other corrosive gas. Box stacking shall comply with specification on the box. Storage period should not exceed 2 years, good stored for more than 2 years will need to pass re-inspection test before use.

8 Caution and Note

8.1 Caution

Caution: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

8.2 Note

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8.3 FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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