



MatchX M2 Pro

16 Channels LPWAN Gateway

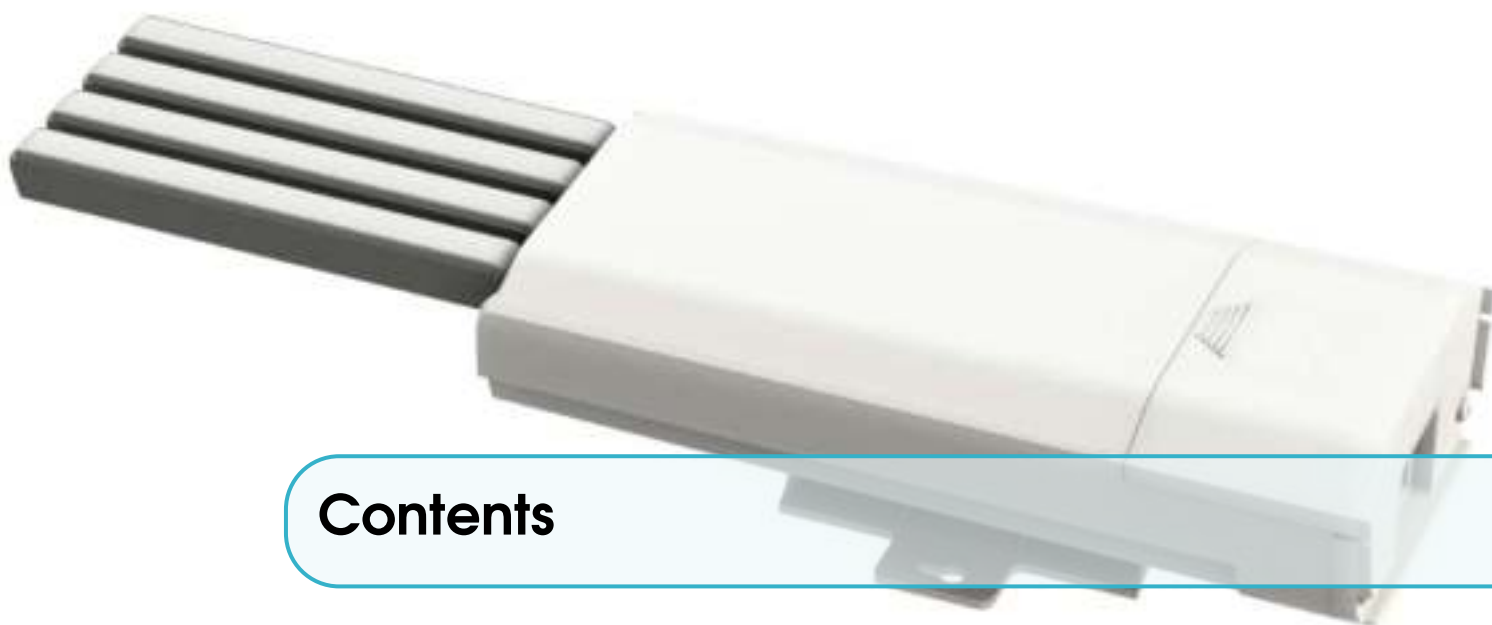
User Guide

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Contents

1	Introduction	5
1.1	Product overview	5
1.2	Product overview	6
1.2.1	LoRa	6
1.2.2	WiFi	6
1.2.3	GPS	6
1.2.4	Processor Subsystem	6
1.3	Interface and Connectors	7
1.3.1	Connector panel of the Gateway	7
1.3.2	Led status	7
1.3.3	Console access	8
1.3.4	Antenna connectors	8
2	Quick Installation Guide	9
2.1	Software requirements	9
2.2	Hardware requirements	9
2.3	Power connection	10
2.3.1	PoE power supply	10
2.3.2	USB-C power supply	10
2.4	Accessing the Gateway and Internet connection	11
2.4.1	Ethernet connection	11
2.4.2	WiFi connection	11

2.5	Mounting	11
2.5.1	Wall Mounting	11
2.5.2	Pole mounting	13
2.6	Surge protection and Shielded Ethernet cable	13
3	Product specification	14
3.1	Hardware Specification	14
3.2	WiFi specification	15
3.3	LoRa Radio specification	15
3.4	GPS Antenna Performance	16
3.5	LoRa Antenna Performance	16
3.6	Operational frequencies	16
4	Package content	18
5	Revision History	19
6	Important Notice	20



1. Introduction

1.1 Product overview

MX190x is an outdoor LPWAN gateway equipped with dual LoRa radio capable of simultaneously receive on 16 frequency channels. It is based on the newest SX1302 LoRaWAN Gateway chip which allows it to use spreading factors from SF5 to SF12. This greatly improves the throughput and decreases the data collisions in dense networks with many sensor nodes compared with previous generation of gateways based on older SX1301. Improvement on performance comes together with significant reduction of power consumption which reduces the cost of operation and increases long time reliability of the devices.

This guide covers the MX1901 and MX1902 version of MatchX M2 Pro Gateway, with the MatchX LPWAN controller version 1.0 or above. The main differences between them are listed in the Table 1.1:

Item	MX1902	MX1901
Band	902-928MHz	863-873MHz
Maximum Conducted Power	+27dBm	+27dBm
LBT	Yes	Yes
No. of Channels	16	16
SF	5-10	5-12
Certification	IEC 60950 -1 FCC PART 15.247	EN 300200 EN 301489
IP Rating	IP66	IP66

Table 1.1: Comparison of MX1901 and MX1902

1.2 Product overview

- Dual LoRa radio with 16 Rx channels
- Half duplex LoRa communication with 2 Tx paths
- 2 LoRa antenna connectors
- Build in GNSS receiver with GNSS engine for GPS/QZSS, GLONASS
- Build in WiFi module with full function of 802.11b/g/n over 2.4GHz
- 100Mbase Ethernet connection with passive PoE 24V power supply
- USB-C interface for debug with Power Delivery capability for power supply
- USB-A general purpose interface
- Internal storage on SD-Card or optional flash SSD
- Secure element for key storage, secure boot and provisioning
- Accelerometer and pressure sensor for temper detection
- Auto diagnostic functions
- IP66, outdoor enclosure
- Industrial temperature range -40°C to +85°C

1.2.1 LoRa

The MatchX M2 Pro fully supports LoRaWAN protocol, covering a massive vicinity of up to 20km+ in open spaces. Thanks to 16 frequencies channels and Spreading Factors as low as SF5 this gateway provides exceptionally good coverage in places with huge number of sensor devices. Based on the newest LoRa chipset SX1302 the Gateway is able to simultaneously demodulated more data packets then it was possible before reducing data collision and allowing for more dense sensor deployment in applications like smart farming, home automation or asset tracking.

1.2.2 WiFi

The MX1901/2 Gateways provide build in WiFi connectivity according to 2.4GHz 802.11b/g/n specification. Thanks to build in antenna no extra installation is needed. WiFi connection can be used to provide internet connection to the Gateway or to access the Web UI configuration page to manage the Gateway. If WiFi connection is not needed it can be disabled to save power.

1.2.3 GPS

The Gateway is equipped with Ublox MAX-7Q GNSS receiver with additional LNA to improve sensitivity and lower time to fix. The GNSS is not only used for location finding of the Gateway but also for time synchronization and precise time stamping of the received LoRa packets.

1.2.4 Processor Subsystem

MatchX M2 Pro gateways are based on the industry standard i.MX6 MCIMX6G2CVM05AB processor from NXP equipped with 256MB of DDR3 RAM and 256MB of Flash memory and it is rated for extended temperature range. The low power consumption, high reliability and security options make this processor ideal for industrial application where those features are at most importance.



Figure 1.1: Connector panel of the Gateway.

1.3 Interface and Connectors

1.3.1 Connector panel of the Gateway

To get access to the connector box of the gateway the cover needs to be removed. The cover is fixed with two screws which secure the cover from falling off during strong winds or when or during interaction with wildlife. After unscrewing the screws and pulling down the cover the connector box is easily accessible and shown on Figure 1.1. The following interfaces are available:

1. Grounding screw connector - connect this with a copper wire to ground.
2. User button - used for resetting the Gateway to the factory settings.
3. RGB LED - this is the status LED. Description of the possible status can be found in Table 1.2.
4. USB-C connector - can be used for accessing the console terminal and to power the Gateway.
5. Ethernet connector with passive 24V PoE capability for internet connection and powering the Gateway.
6. USB-A 2.0 - USB host for connecting extension devices like mass storage.

1.3.2 Led status

The Gateway uses an RGB LED to indicate a various status and its condition. Description of the LED status can be found in Table 1.2.

LED Color	Activity
Flashing Blue	Initializing
Steady Blue	Connected to Internet, no LoRaWAN is configured
Alternative Blue and Red	Device is busy, don't unplug power
Steady Red	No Internet connection or LoRaWAN sever not available
Flashing Green	Configuring Box
Steady Green	Indicates that the Gateway is connected and working normally

Table 1.2: LED activity of the Gateway

1.3.3 Console access

On default the console terminal of the Gateway can be accessed through USB-C connector. Internally CP2104 UART-USB converter is used, if the drivers for this device are not automatically installed on the PC operating system they can be downloaded from Silicon Labs website.

The PC should detect the Gateway as Virtual COM port. Any terminal software capable of communicating through COM port can be used e.g. PuTTY or RealTerm. The default settings are:

- Baud rate - 115200
- Parity - none
- Stop bit - one
- Data bits - 8 bits

If the console output on USB-C port is not desirable it can be disabled in software.

1.3.4 Antenna connectors

The Gateway is equipped with four high grade SMA connectors. The connectors are waterproof and located on the top of the Gateway. The RF antennas can be attached directly to SMA connectors or can be connected with RF cable if the antenna is to be mounted in different location or the physical size of the antenna doesn't allow for direct connection.

The location and numbering of the connectors can be seen on Figure 1.2. The functions are as follows:

1. LoRa radio 1
2. LoRa radio 2
3. Spare connector - can be used for optional 3G/4G modem or WiFi
4. GNSS



Figure 1.2: Antenna connectors of MX1901/2 Gateway.



2. Quick Installation Guide

The MX1901/2 Gateway is preconfigured "Plug 'n Play" device, which mean installation is extremely easy. At first power up the Gateway will connect to MatchX network without any need of setup. This installation guide will guide through process of configuring the Gateway and it's LoRa parameters.

Every Gateway comes with a unique serial number and QR code placed under the cover of cable compartment. Either of them can be used for setting up the GW on the Cloud server. The list and links to the Cloud servers can be found on MatchX website under <https://www.matchx.io/>

2.1 Software requirements

To use the MatchX M2 Pro Gateway no special software is required, as the Gateway is preconfigured to connect to the MatchX Cloud server. To access the Cloud Server a computer or mobile devices with a web browser such as Chrome or Firefox is sufficient.

To make the installation easy it is possible to use a mobile device with QR code reader for easy registration on the chosen Cloud Server.

2.2 Hardware requirements

The hardware of the MatchX M2 Pro Gateway is design in such a way that it needs minimum number of external components to make it functional. The user has few different connection options he/she can choose from to make the installation easy and convenient.

Depending on the installation option (described in next sections) the following components can be needed:

- PC computer or Mobile device
- Ethernet cable
- USB-C cable
- Access to AC power outlet
- WiFi router or Ethernet switch
- Screw driver and similar tools

2.3 Power connection

The Gateway offers two ways of supplying power:

- Passive 24V DC PoE
- USB-C

2.3.1 PoE power supply

On Figure 2.1 the PoE connection is illustrated. The injector has two RJ45 connectors marked as POE and LAN. It is important to pay attention to correct connection of this connectors:

- POE connector needs to be connected with Ethernet cable to the RJ45 connector of the Gateway.
- LAN connector needs to be connected with Ethernet cable to Internet router or switch.

The PoE injector needs to be connected to 230/110V AC power outlet.

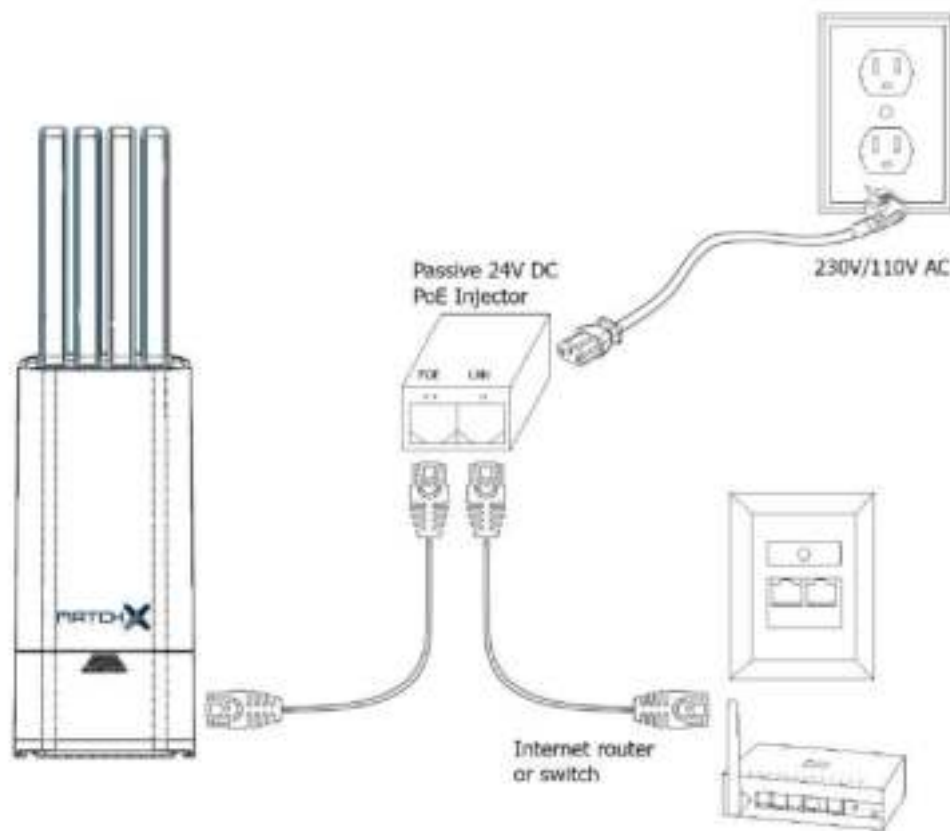


Figure 2.1: Connection of MX1901/2 Gateway.

2.3.2 USB-C power supply

MX1901/2 Gateways can be powered from USB-C connector. It does implement **USB PD rev 2.0** and is interoperable with **USB PD rev 3.0** standard up to 22V.

It is recommended to use a dedicated USB-C power supply which implements USB PD standard and has enough power capability. Powering the Gateway from USB port of PC or similar is not recommended because of limited current capabilities of those ports.

2.4 Accessing the Gateway and Internet connection

The Gateway needs internet connection in order to communicate with LoRaWAN server such as MatchX Cloud Server. There are two primary ways to provide such connection: Ethernet cable (preferred) or WiFi. For 3G/4G connection option please contact MatchX support or sales department.

2.4.1 Ethernet connection

Ethernet cable is a preferred way of connecting because it provides more reliable internet access and the same cable can be used to deliver 24V DC power to the Gateway. The PoE injector power supply is included together with Gateway so the user doesn't need to spend time searching for compatible model. The connection between Gateway, PoE injector and Internet router should look like the one depicted on Figure 2.1.

After power up the Gateway should automatically get IP address assigned by the DHCP server usually running in the network. To find out the assigned IP address user can login to the router and see the list of assigned IP addresses or scan the entire local network using any available software tool like AngryIP, the gateway will appear with its serial number as hostname. After obtaining the IP address it can be used directly in the web browser like Chrome or Firefox to get access to Gateways web configuration interface if needed. If gateways autoconfiguration process was successful and internet access is available the LED should turn steady green.

2.4.2 WiFi connection

The WiFi interface of the Gateway works in Access Point mode by default. The SSID of the network generated by the device has a general format of: *MatchX_MX190x_yyyy*, where: yyyy - 4 last bytes of MAC address. The default password of the WiFi network is the serial number of the Gateway. After connecting to the network IP address will be automatically assigned to the PC or mobile device. The Web User Interface of the Gateway can be accessed by its IP address (192.168.0.1).

From the Web Interface it is possible to configure the Gateway to connect to other WiFi network and use it for internet connection. In this case there is no need to connecting a Ethernet cable between LAN port of the PoE injector and Internet router.

2.5 Mounting

This device must be professionally installed by qualified person. The Gateway is IP67 rated and can be mounted outside in vertical position. Vertical position is crucial to ensure the environmental resistance of the Gateway. Keep in mind that PoE power injector is not waterproof and has to be additionally protected if it is to be placed outside.

2.5.1 Wall Mounting

The screws and screw anchors are included in the package, users can drill two 6mm hole on the wall and apply screw anchors to them.

- Determine the place of mount, it should be an even surface.

- Mark two holes that are going to be drilled, the distance between them. should be 54mm, and they should be horizontally aligned .
- Drill two 6mm hole, apply screw anchors and screws.
- Adjust the screw spacing.
- Push the screws heads through the larger opening hole of the Gateways fixture and then pull the Gateway down so the screws get locked in position.



Figure 2.2: Mounting the MX1901/2 Gateway to the wall.



Figure 2.3: Mounting the MX1901/2 Gateway to the pole.

2.5.2 Pole mounting

The Gateway can be easily connected to a pole using a stainless steel clamp included in the box. The Gateways fixture is specially designed to fit to poles curvature. To make the mounting even more stable it is a good idea to use two clamps spaced as far apart as possible.

- Determine the place of mount, we recommend a round pole
- Position the Gateway on desired place, and fasten the stainless steel clamp.
- Tighten the screw of the clamp enough to make the mounting stable but not too much to brake the plastic fixture of the Gateway.

2.6 Surge protection and Shielded Ethernet cable

We highly recommend to use the shielded RJ45 cable to connect the Box, in order to protect the device from any possible lightning or electricity surges. Both shielded FTP and S-FTP cable from Cat5e are recommended. To protect the Gateway and Ethernet equipment connected to it we highly recommend using lightning and surge protectors near the Gateway and near the PoE.



3. Product specification

3.1 Hardware Specification

Feature	Description
CPU	NXP MCIMX6G2CVM05AB, 528MHz, Arm Cortex-A7
Memory	256MB DDR3 RAM/ 256MB NAND FLASH
Storage Memory	Optional SSD up to 32GB or industrial SD-Card
LoRa Radio	Two independent radio channels SX1302 chipsets, 16 frequency channels SF5-SF12, 27dBm output power 8 x 8 channels LoRa packet detectors per radio channel Supports EU868, US915, AS920, AS923, AU915, KR920, IN865 regions
WiFi	2.412GHz – 2.484GHz, IEEE 802 Part 11b/g/n (802.11b/g/n)
GPS	UBlox Max 7Q GNSS receiver with additional LNA
Ethernet	RJ45 10/100 Mbit LAN with 24V POE
Console	through USB-C as virtual COM port
LEDs	RGB LED status indicator
Interface	USB-C with PD for console UART and Power USB-A 2.0 Host Reset Button
Internal Sensors	3-Axis Accelerometer Pressure Sensor Temperature Sensors Voltage and Current monitoring
Antenna interface	4x SMA connectors, waterproof
Power Supply	24V DC passive PoE or USB-C PD rev 2.0 up to 22V
Power Consumption	3.5W in average, peak 6W
Operating Temperature	-40°C to 85°C

Feature	Description
Enclosure	ASA plastic, anti-UV
Size (without antennas)	101 x 226 x 73mm
Weight	0.4kg
Installation method	Pole or Wall mounting

Table 3.1: Key hardware specifications.

3.2 WiFi specification

Feature	Description
Chipset	Broadcom 43362
WLAN Standards	IEEE 802 Part 11b/g/n (802.11b/g/n)
Antenna Port	Support Single Antenna for WiFi
Frequency Band	2.412 GHz – 2.484 GHz
Number channels	14
Modulation	OFDM, DSSS (Direct Sequence Spread Spectrum), DBPSK, DQPSK, CCK , 16QAM, 64QAM
Supported rates	1,2, 5.5,11,6,9,12,24,36,48,54 Mbps
Maximum receive level	-10dBm (with PER < 8%)
Output Power	17 dBm +2/-2 dBm for 1, 2, 5.5, 11Mbps 14 dBm +2/-2 dBm for 6, 9, 12, 18, 24, 36, 48, 54 Mbps 12 dBm +2/-2 dBm for 11n (HT20)
Internal Antenna Gain	2 dBi (Typical)
Internal Antenna Polarity	Linear
Antenna Azimuth Beamwidth	Omni-directional
PER <8%, Rx Sensitivity @ 1 Mbps	-94 dBm Typical
PER <8%, Rx Sensitivity @ 11 Mbps	-87 dBm Typical
PER <10%, Rx Sensitivity @ 54 Mbps	-73 dBm Typical
PER <10%, Rx Sensitivity @ MCS0	-86 dBm Typical
PER <10%, Rx Sensitivity @ MCS7	-70 dBm Typical

Table 3.2: Key WiFi specification.

3.3 LoRa Radio specification

Feature	Description
Chipset	2x Semtech SX1302
Operating Frequency MX1901	EU868, IN865
Operating Frequency MX1902	US915, AS923, AU915, KR920
Frequencies channels per SX1302 chipset	8 LoRa® channels multi-data rates (SF5 - SF12 / 125 kHz) + + 2 mono-data rate (LoRa® 250 / 500 kHz and FSK 50 kbps)
Antenna Port	2x SMA
Transmit Power	27 dBm

Feature	Description
Typical sensitivity level (EU868/US915)	-141 dBm at SF12 BW 125 kHz -127 dBm at SF7 BW 125 kHz -111 dBm at FSK 50 kbps

Table 3.3: LoRa Radio specification.

3.4 GPS Antenna Performance

Feature	Description
Frequency range	1574 - 1606MHz
Impedance	50ohms
VSWR	<1.2:1
Max gain	2.5dbi
Polarization	Vertical
Radiation Pattern	Omni-directional
Connector	SMA(M)
Length	108mm
IP Rating	IP66

Table 3.4: GPS Antenna performance

3.5 LoRa Antenna Performance

Feature	Description
Frequency range	863-873MHz
Or	902-928MHz
Impedance	50ohms
VSWR	<1.2:1
Max gain	2.5dbi
Polarization	Vertical
Radiation Pattern	Omni-directional
Connector	SMA(M)
Length	108mm
IP Rating	IP66

Table 3.5: Lora Antenna performance

3.6 Operational frequencies

MatchX Gateways are tested to work with regional frequency specifications regulated by the authorities responsible for given region. The user needs to pay attention to the local regulation and

configure the Gateway to use proper regional settings. Table 3.6 shows example of the frequency allocation in EU868 region. Other geographic regions need to comply with their specific set of rules. LoRa Alliance is regularly publishing a summary of the regulations on their website.

Operational Frequency band		Maximum e.r.p	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Band number from EC Decision 2013/752/EU [i.3]	Class 1 subclass number according Commission Decision 2000/299/EU [i.7]
K	863,000 MHz to 865,000 MHz	25 mW e.r.p.	$\leq 0,1\%$ duty cycle or polite spectrum access	46a	66
L	865,000 MHz to 868,000 MHz	25 mW e.r.p. Power density: -4,5 dBm/100 kHz	$\leq 1\%$ duty cycle or polite spectrum access	47	67
M	868,000 MHz to 868,600 MHz	25 mW e.r.p.	$\leq 1\%$ duty cycle or polite spectrum access	48	28
N	868,700 MHz to 869,200 MHz	25 mW e.r.p.	$\leq 0,1\%$ duty cycle or polite spectrum access	50	29
O	869,400 MHz to 869,650 MHz	25 mW e.r.p.	$\leq 0,1\%$ duty cycle or polite spectrum access	54a	130
P	869,400 MHz to 869,650 MHz	500 mW e.r.p.	$\leq 10\%$ duty cycle or polite spectrum access	54b	30
Q	869,700 MHz to 870,000 MHz	5 mW e.r.p.	No requirement	56a	31
R	869,700 MHz to 870,000 MHz	25 mW e.r.p.	$\leq 1\%$ duty cycle or polite spectrum access	56c	69

Table 3.6: EU wide harmonized national radio interfaces.



4. Package content

MatchX M2 Pro LPWAN Gateway comes in a package containing:

- Gateway
- LPWAN and GNSS antennas
- Power Supply and power cord
- Mounting facilities (screw anchors, screws and stainless steel clamp)

The package doesn't contain Ethernet cables as their length and type is specific to installation setup.



MX1901/2 Gateway (1 pcs)



Antenna (3 pcs)



30mm M6 Screw anchor, M4 Screw (3 sets)



Stainless Steel Clamp (1 pcs)



24V POE (1 pcs)



Power cords (1 pcs)



5. Revision History

Revision	Description	Date
1.0	Initial Release	15.03.2020



6. Important Notice

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