



in:xtnd™

in:xtnd™ Control C251
Hardware User Manual

INCOAX



Document History

Date	Rev	Originator	Description
2019-12-18	V.1	Claes Levinsson	Initial version converted from former document for "in:xtnd™ Control MA2.5".

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1 Definitions and Abbreviations

1.1 Definitions

Table 1 shows the terminology and definitions that are being used in this document.

Table 1 — Definitions of the Terminology.

Term	Definition
Access Modem	in:xtnd™ Access is a coax to Ethernet network terminal providing 2 × 1 Gbps Ethernet interfaces. in:xtnd Access 2 Ethernet communicates with the in:xtnd Controller 4 port and is based on the MoCA Access™ 2.5 standard. The in:xtnd Access Modem is installed in the subscribers' premises. This device will be referred to as the <i>Modem</i> in this document.
Controller	in:xtnd™ Control C251 is a single channel broadband over coax access node, capable of 2.5 Gbps on the RF port supporting up to 31 in:xtnd Modems. The communication with the Modems is based on the MoCA Access™ 2.5 standard. This device will be referred to as the <i>Controller</i> in this document.
Customer	End user.
Diplexer	in:xtnd™ Combine ACX is a high-performance frequency combiner. The combiner is designed to be used for connecting one or two MoCA Access channels for an in:xtnd™ Controller and FM/VHF into a single coaxial cable combining FM/VHF and broadband access in a single coax cable. This device will be referred to as the <i>Diplexer</i> in this document.
Management System	in:xtnd™ Manage MA2.5 is a cloud-based, advanced element manager with features for Controller deployment, control, and supervision of the coax link conditions. It includes essential functions for service provisioning and network management. This device will be referred to as the <i>Management System</i> in this document.
MoCA Access	MoCA Access™ 2.5 standard is a point-to-multipoint access network. It is designed to coexist with legacy services such as TV, DOCSIS, and cellular (4G/5G) technologies. The operating frequency range is between 400 MHz and 1675 MHz. See reference {a} .
Trunk	The Trunk is the uplink port from the <i>Controller</i> . It uses SFP modules.

1.2 Abbreviations

The abbreviations that are used in this document are defined in **Table 2**.

Table 2 — Abbreviations.

Abbreviation	Description
CATV	Cable TV.
CE	CE marking is a certification mark that indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area.
CPE	Customer-Premises Equipment or Customer-Provided Equipment.
C-VLAN	Customer VLAN is the VLAN that the customer uses or sees (the inner tag). CVLAN is the VLAN tag the customer is using on their own devices. (See QinQ.)
DHCP	Dynamic Host Configuration Protocol is an automatic configuration protocol used to automatically assign IP addresses to devices on a TCP/IP network.
EMC	ElectroMagnetic Compatibility.
FCC	The Federal Communications Commission is an independent agency of the United States government created by statute to regulate interstate communications by radio, television, wire, satellite, and cable.
IGMP	Internet Group Management Protocol is a protocol used to establish multicast group membership.
MAC Address	Media Access Control address is a unique identifier assigned to a Network Interface Controller (NIC) for communications at the data link layer of a network segment. MAC addresses are used as a network address for most IEEE 802 network technologies, including Ethernet, WiFi, and Bluetooth.
MGT	Denotes the Management port on the <i>Controller</i> .
OFDM	Orthogonal Frequency-Division Multiplexing is a method of encoding digital data on multiple carrier frequencies.
PHY	Physical bit rate.
PPPoE	Point-to-Point Protocol over Ethernet is a network protocol for encapsulating PPP frames inside Ethernet frames.
QAM	Quadrature Amplitude Modulation is the name of a family of digital modulation methods and a related family of analog modulation methods widely used in modern telecommunications to transmit information.
QinQ	An Ethernet networking standard informally known as QinQ, was incorporated into the base 802.1Q standard in 2011. {b} The 802.1Q technology improves the utilization of VLANs by adding another 802.1Q tag to tagged packets. (See C-VLAN and S-VLAN.)
QoS	Quality of Service is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
QPSK	Quadrature Phase-Shift Keying.
RoHS	Restriction of Hazardous Substances directive 2011/65/EU {c} . This short for <i>Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment</i> , was adopted in February 2003 by the European Union. It is required to be enforced and became a law in each member state on 1 July 2006. The RoHS 2 directive (2011/65/EU) is an evolution of the original directive and became law on 21 July 2011 and took effect on 2 January 2013. It addresses the same substances as the original directive while improving regulatory conditions and legal clarity.
SerDes	Serializer/Deserializer is a pair of functional blocks commonly used in high speed communications to compensate for limited input/output.
SFP/SFP+	Small Form factor Pluggable transceiver. SFP ≤ 1 Gbps and SFP+/Enhanced ≤ 10 Gbps.
SOAP	Simple Object Access Protocol is a protocol for exchanging structured information.
S-VLAN	Service VLAN is the VLAN that the service provider network sees (the outer Q-tag). SVLAN is the VLAN the service provider puts the entire customer traffic in. (See QinQ.)
TCP/IP	Transmission Control Protocol/Internet Protocol is the architecture for data communication over networks.
TDD	Time Division Duplex is the topology adopted to make communication between two wireless devices at one frequency but with two different time instants.

in:xtnd™



Abbreviation	Description
TDMA	Time-Division Multiple Access is a channel access method for shared-medium networks.
URL	Uniform Resource Locator is the address of a resource on the Internet.
UTP	Unshielded Twisted Pair.
Web GUI	Web Graphical User Interface is a user interface that allows users to interact with in:xtnd electronic devices through a web page.
WEEE	Waste Electrical and Electronic Equipment.
XML	eXtensible Markup Language is languages which describe the information.

2 Package Content

Check that you have the accessories and items as shown in **Table 3**.

(The images are illustrations and may differ from the real items.)

Table 3 — Contents of the package.

Product	Item Description	Item picture
in:xtnd™ Controller C251	Broadband over coax access node, capable of 2.5 Gbps on the RF port.	
Quick Guide	Quick Guide	
Power Adapter YSV10-1201000	12 VDC See section 0 on page 12.	

Kommenterad [CL1]: Ny bild!

Kommenterad [CL2]: Måste specia PS i mer detalj pga typprovning. Räcker detta?

3 Read This First

Always make sure to connect all coaxial cables and network cables before connecting the power cable. This must be done to avoid electrical shock and to avoid damage to the unit. Ground loops might build up enough electrical charge to give an electrical shock if not properly connected before connecting the power cord. Make sure to connect the Cable TV (CATV) amplifier's ground connection to the *Controller* unit if both the CATV amplifier and *Controller* are installed in the same physical location. If the CATV-amplifier is located far away on the coaxial network, the *Controller* unit must not be grounded because this will create a ground loop.



When Using the Controller

The *Controller* is designed to operate on 12 VDC. If the unit is not powered using the power supply delivered with the *Controller*, but in any other way directly or indirectly with 12 VDC, a 5 A fuse must be fitted to the power cable.

Please observe the following:

- Do not stick any foreign objects, like metal or flammable objects into the *Controller* or its ventilation holes, as this can cause fire or electric shock.
- Do not remove the cover or modify it in any way.
 - High voltages which can cause severe electric shocks are present inside the *Controller*. For any inspection, adjustment, and repair work please contact your local InCoax dealer. The warranty is void if the cover has been opened.
 - Never attempt to repair this product yourself. Improper repair work can be dangerous. Never disassemble or modify this product. Tampering with this product may result in injury or fire.
- Do not handle the power supply plug with wet hands as this may cause electric shocks.
- Do not use in locations subject to high humidity or dust levels, as this may cause damage to the equipment or start a fire.
- Do not do anything that may damage the power cable. When disconnecting the power cable, pull on the plug body, not the cable.
- Do not damage a power cable, make any modifications to it, place heavy objects on top of it, heat it, place it near any hot objects, twist it, bend it excessively, or pull it. To do so may cause fire and electric shock. You should discard the power cable if it is damaged in any way.
- The power cable shall also be discarded if the plug is damaged.
- Do not place heavy objects on top of the *Controller*.
- Securely insert the power supply plug as far as it will go.
- Unplug all cables connected to the *Controller* before moving it.

It is recommended to unplug the power supply from the wall outlet or the unit if the *Controller* is not going to be used for any prolonged length of time.

Network Requirements

Please consider the following during the installation of the *Controller*.

The risk of potential differences and the spread of voltage from faulty equipment are largely linked to the design of the power installation in the building. If the coax connections are not galvanically separated according to the standard EN 60728 **{d}** then a galvanic separator, e.g. Soontai Isolator IS9 SG, shall be used between the coax connection and the *Controller*.

In terms of potential equalization, the EN 50083-1 **{e}** and EN 60728 shall be followed. Cable distribution systems shall be designed and constructed so that no dangerous voltages can occur in the external conductors of any cables or in metal cases on passive parts.

Warning

If the *Controller* is installed in an environment where the surrounding temperature is at least 50 °C (degrees Celsius), the coax connectors can reach a temperature of at least 85 °C. In this case the coax connectors must not be covered with or in contact with combustible materials due to the risk of fire.





Installation Environment

Install the *Controller* in a site free from strong electromagnetic field generators (such as motors), vibration, dust, and direct exposure to sunlight.

Install the *Controller* in a fairly cool and dry place for the acceptable temperature and humidity operating ranges. See **section 6** on page 11 for the actual temperature ranges.

Install the *Controller* on a sturdy, level surface that can support at least 5 kg (11 lbs) of weight. Leave at least 10 cm (4 inches) of space at the front for the coax cables.

Connect a 75-ohm terminator (F connector) in all coax ports that are not used on the *Controller*.

Make sure that there are no insulating materials that can cover the *Controller* by accident.

Please also make sure that there are no corrosive liquids or materials that can emit any corrosive gases in the same room as the *Controller*.

Storage Environment

The ideal storage location is a dry and well-ventilated location, e.g. in a space with climate-control. Please refer to **section 6** on page 11 for more details about the specified environmental conditions.

Theft and Vandalism

Depending on the circumstances for the installation it may be appropriate to mount the equipment (i.e. the *Controller*, and eventual *Diplexers* and *Switches*) in a cabinet that can be locked securely.

4 Introduction

This document describes some features for a *Controller* of the model “in:xtnd™ Control C251”. It also has a technical specification, as well as information about the regulatory statements and the proper disposal of the equipment.

This model of the *Controller* provides a throughput of 2.5 Gbps for the available single coax port.

4.1 The in:xtnd™ System

InCoax™ is a provider of broadband access solutions leveraging existing in-building coaxial cable networks. The in:xtnd™ System consists of a *Management System* which manages the *Controllers* installed in, or near, buildings and *Modems* installed in the customers’ homes. An illustration of the *Management System* can be seen in **Figure 1**. The *Modem* is easily installed by the customers without any requirements for configuration. This architecture makes the system very flexible. Once the *Controller* has been installed in, or near, the building the only required operation to connect new customers is to provide them with a *Modem*. As soon as the *Modem* has been connected to the coax network, it will automatically be detected and properly configured by the *Controller* through the *Management System*.

The typical in:xtnd™ System consists of one *Management System* which handles hundreds of *Controllers* and thousands of *Modems*. If there is a legacy cable-TV service in the building the TV signal can be multiplexed with the broadband signal using the *Diplexer*. The *Management System* is used as a customer configuration, monitoring, and provisioning tool through a web interface. In larger networks the *Controller* functions used by the *Management System* can be accessed by any other provisioning system or Operating Support System through a SOAP/XML interface.

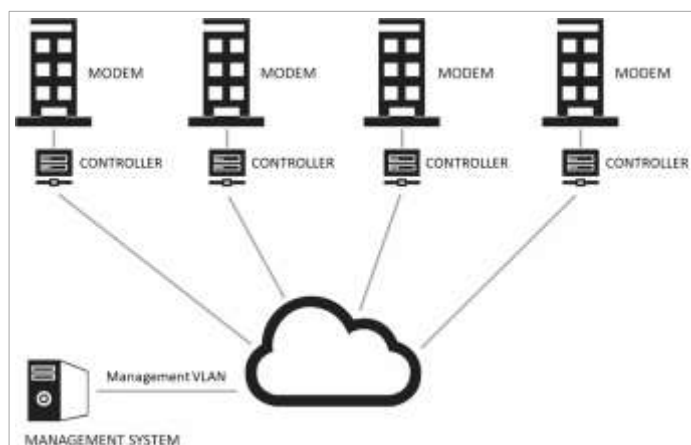


Figure 1 — Overview of the Management System.

4.2 The in:xtnd™ | Manage | MA2.5

The *Management System* is a software package installed in a Linux environment. It manages the *Controllers* and *Modems*. The *Management System* automatically detects new *Modems* and manages the mapping of subscriber data. It also collects and presents communication statistics parameters and priorities. Furthermore, it measures and presents the RF link quality in real time and handles various alarms to the operator.

4.3 The in:xtnd™ Control C251

The *Controller* acts as a bridge between the Ethernet access network and customers’ local area Ethernet, using the in-building coaxial network as transport for data traffic to the *Modems*. The *Controller* communicates with all *Modems*, over dedicated RF channels, in the coaxial network to manage their individual configuration, enforces traffic, and security policies. It also collects and stores traffic statistics data from the network.

4.4 The in:xtnd™ Access

The *Modem* is an Ethernet network terminal. It is available as a *Modem* with one or two ports. Both have different variants depending on which MoCA band is used. They are labeled AA, AC, and AD in accordance with the MoCA bands A - A, A - C, and A - D. There is also a variant for “All IP”.

The *Modem* connects to any antenna outlet in the subscribers’ homes for easy self-installation. It communicates with the *Controller* to get configuration parameters and connects to the subscribers’ local area Ethernet e.g. usually a residential gateway using Ethernet CAT cables with RJ45 plug. (InCoax recommends using CAT5e cable type as a minimum for best performance.) The firmware of the Modem can be upgraded from the *Controller*.

4.5 The in:xtnd™ Quality of Service

The in:xtnd™ *Controller* supports up to four queues, broadcast and multicast Quality of Service (QoS). It also supports prioritization between unicast and broadcast/multicast, and classification. Unicast QoS can be set individually for each *Modem*.

4.6 The in:xtnd™ Basic Product Connection

Figure 2 shows an example of the in-building connections for the basic products.

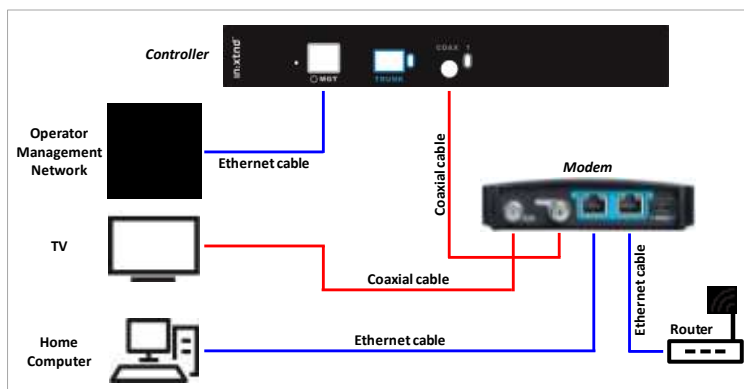


Figure 2 — Overview of the basic in-building connections.

5 Controller Web Interface

The *Controller* can be managed via the management port using a web interface. Please refer to the InCoax document “in:xtnd™ Control Software User Manual” for a more detailed description of the web interface and how to set up the *Controller*. See reference {f}.

5.1 Accessing the Controller Web Interface

1. Connect a computer with an Ethernet cable to the Management port on the *Controller*, marked **MGMT**. See **Figure 3**. (InCoax recommends using the cable type CAT5e as a minimum for best performance.)
2. Set a static IP for your computer connection, for example 192.168.144.100 (or any IP between 192.168.144.1 and 192.168.144.254 but not the same as the default IP address) and Subnet Mask 255.255.255.0.
3. Open your web browser and go to the URL https://192.168.144.20. The web page in **Figure 4** will be displayed. Input the following to log in:
 - a. Default Username: **incoax**
 - b. Default Password: **incoax**

For best user experience InCoax recommends you to enable JavaScript.



Figure 3 — The front of the Controller.



Figure 4 — The login page.

5.2 User Levels and Permissions

There are two different user levels with different purposes and permissions:

- **View Only:** Demonstration and supervision. The *View Only* users can view some managed objects and settings but cannot add or change anything.
- ◆ **Admin:** *Controller* and *Modem* management. The *Admin* users can add and change managed objects and settings. This is the standard user level.

Table 4 gives a detailed view of what the two user levels are allowed to do.

Table 4 – User level permissions.

Operation	View Only	Admin
View Controller	●	◆
View Modem	●	◆
View Service	●	◆
View Controller Statistics	●	◆
Use port Spectrum	●	◆
View Modem Statistics	●	◆
View Alarms	●	◆
View Modem Default Configurations	●	◆
View Users	●	◆
View SOAP Configurations	●	◆
Add/edit/delete Modem		◆
Add/edit/delete Service		◆
Upgrade Modem Firmware		◆
Add/edit/delete Multicast Groups		◆
Edit Coax Ports		◆
Add/edit/delete Service VLAN		◆
Edit Service and QoS		◆
Edit Priorities		◆
Edit Advance Settings		◆
Use Ping and Traceroute Tools	●	◆
View Hardware	●	◆
Download Logs	●	◆
View Settings	●	◆
Add/edit/delete Settings		◆
Add/edit/delete Network Settings		◆
Modify Users		◆
Modify Own Account Settings	●	◆
Modify SOAP Configuration		◆
Manage of Controller Firmware		◆
Reboot Controller		◆

6 Specifications

6.1 in:xtnd™ Control C251

The electrical, physical and functional specifications for the in:xtnd™ Control C251. Please note that the specification may be subject to change.

Performance	<ul style="list-style-type: none"> • Based on MoCA Access 2.5 Profile D. See reference {a}. • 10 Gbps WAN interface. • 2.5 Gbps throughput for the MoCA port. (3.0 Gbps in turbo mode.) • 31 Modems for port. • MoCA Bands: A - A, A - B, A - C, A - D, and A - E. • Frequency range: 400 to 1675 MHz. • RF channel bandwidth: 100 MHz. • Bonded operation supporting 3, 4, or 5 RF channels. • MAC Rate typically 1.5, 2.0, or 2.5 Gbps (up to 3.0 Gbps). • PHY / MAC rate: up to 730 / 600 Mbps per 100 MHz RF channel. • 100 % link quality up to 60 dB attenuation. • 17 dBm maximum output power; automatically adjusted per modem. • Configurable beacon frequency. • Modulation: OFDM, QAM 8, 16, 32, 64, 128, 256, 512, or 1024; BPSK and QPSK. • Multiplexing methods: TDMA/TDD.
Physical	<ul style="list-style-type: none"> • Northbound fiber port. • 1 × SFP+ port: Multi Source Agreement (MSA) compliant, SerDes – 10 Gbps data rate, SFF-8472 (see reference {h}) – Diagnostics interface.^a • 1 × Management Ethernet port: 10 / 100 Mbps, configuration and statistics port. • RJ-45 connector supports type CAT5 UTP (as a minimum). • F-female connector - 3/8-UNEF32, 75 Ω. • Reset button for executing system reset and enter a default state.
Indicators	<ul style="list-style-type: none"> • Power on, Management, Trunk, Coax Link traffic, and alerts.
Dimensions	<ul style="list-style-type: none"> • 323 × 57 × 194 mm (W × H × D). • Prepared for 19" rack chassis installation. • Prepared for wall mount.
Weight	<ul style="list-style-type: none"> • 3.2 kg
Environmental	<ul style="list-style-type: none"> • Operating temperature: -25 °C to +50 °C. • Relative humidity: 20 % to 80 %. • Altitude: maximum 2000 m. • Dynamic temperature control with cooling redundancy. • Abnormal operation conditions alarms. • Storage (non-condensing): -40 °C to +70 °C and 5 % to 90 % relative humidity. • RoHS and RoHS2. See reference {c}. • UL 94 V-0. See reference {i}.
Power	<ul style="list-style-type: none"> • 12 VDC, 5 A maximum. • Power consumption is 17 W nominal. • Automatic power on after power grid failure.

Kommenterad [CL3]: Skall detta vara med?

Kommenterad [CL4]: Stämmer dessa?

Kommenterad [CL5]: Stämmer detta?

^a InCoax recommends using the SFP+ module "MikroTik 10G S+RJ10".

Other SFP+ modules that are tested:

Ubiquiti 10G UDC-2;

Fiber MM: Ubiquiti 10G UF-CoaxMM-10G;

Fiber SM: Ubiquiti 10G UF-SM-10G, In 10G OS-SP96-3110D, Ubiquiti Bi-Di UF-SM-10G-S.

- IEEE Standards**
 - IEEE 802.1ad - QinQ. **{fj}**
 - IEEE 802.1p - Priority tags. **{g}**
 - IEEE 802.1Q - with full VLAN-ID range up to 200 VLAN. Configurable internal VLAN for policing, shaping, and prioritization for ingress untagged frames. **{b}**
 - IEEE 802.3 - Ethernet. **{k}**
 - IEEE 802.3ac - Q-tag. **{l}**
 - IEEE 802.3u - Fast Ethernet. **{m}**
- Approvals**
 - CE (see **section 7.1.3**). **{n}**
 - EN 300386 V2.1.1. **{o}**
 - EN 50581:2012. **{p}**
 - EN 55035:2017. **{q}**
 - EN 62368-1:2014. **{r}**
 - FCC Class A (see **section 7.1.1**). FCC ID 2ATQM1000-0376 **{s}**
- Security**
 - DHCP snooping, Option 82 rewrite and trusted/untrusted clients, limit setting, configurable options per VLAN.
 - Blocking of unknown CPE.
 - Broadcast storm protection from clients.
 - Support for PPPoE IA option 0x105 Remote ID.
- Multicast**
 - IGMP snooping (v1, v2, and v3 (partially)).
 - IGMP filtering per VLAN.
 - Configurable IGMP timeout.
 - Multicast VLAN Registration.
 - Bandwidth reservation per multicast group.
- QoS**
 - Traffic classification.
 - Mapping and remarking.
 - Congestion management.
 - Strict priority, four separate queues for broadcast, multicast, and unicast.
 - Configurable rate limitation per queue.
 - Configurable upstream/downstream ratio.
- Management**
 - IPv4 WEB GUI via https.
 - SOAP/XML interface via https.
 - Statistics and system/version information.
 - Configuration.
 - Define and assign service profiles.
 - Built in spectrum analyzer.
 - Access through management VLAN or separate management ethernet port.
 - Remotely upgradable.

6.2 Power Adapter YSV10-1201000

- Physical Properties**
 - Voltage input: 100 to 240 VAC 50/60 Hz 0.4 A maximum
 - Protection class II
 - Over voltage category II
- Environmental**
 - Operating Temperature: 0 °C to +50 °C
 - Humidity: 20 % to 80 %
 - RoHS, RoHS2, UL94-V0
 - Altitude max 2000 m
 - Storage environment: -20 °C to +50 °C; 5 % to 90 % (non-condensing)
- Dimensions**
 - 97 × 28 × 112 mm (W × H × D)
- Weight**
 - 160 g

7 Legal Information

7.1 Regulatory Notice and Statement (Class A)

Model List: in:xtnd™ C251

7.1.1 United States of America

The following information applies if you use the product within the USA area.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. See reference **{s}**. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.



Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

7.1.2 Canada

The following information applies if you use the product within the Canada area.

Industry Canada ICES Statement

CAN ICES-3(A)/NMB-3(A). See reference **{t}**.

7.1.3 European Union

The following information applies if you use the product within the European Union.


CE EMC Statement

Warning: This equipment is compliant with Class A of EN 55032. In a residential environment this equipment may cause radio interference. See reference **{n}**



8 Disposal of Equipment

The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community Directive 2002/96/EC on waste electrical and electronic equipment which, together with the Restriction of Hazardous Substances Directive (RoHS Directive) 2002/95/EC (also known as RoHS 1) became European Law in February 2003. The WEEE Directive was amended into the Directive 2012/19/EU and the RoHS 1 has been evolved into the RoHS 2 Directive 2011/65/EU. See references {u} and {c}, respectively.

The symbol adopted by the European Council to represent WEEE comprises of a crossed-out wheelee bin. The black rectangle below the wheelee bin indicates that the product has been placed on the market after 2005, when the WEEE Directive came into force. The symbol shall be placed on the products, packaging, and/or accompanying documents. It means that used electrical and electronic products and batteries should not be mixed with general household waste but taken to a designated collection site as indicated by the local authorities. In accordance with national legislation and the WEEE Directives 2002/96/EC and 2012/19/EU, and the Battery Directive 2006/66/EC amended by 2013/56/EU. See reference {v}. 

For more information about collection and recycling of old products and batteries, please contact your local municipality, your waste disposal service or the point of sale where you purchased the items. Penalties may be applicable for incorrect disposal of this waste, in accordance with national legislation.

8.1 For Business Users in the European Union

If you wish to discard electrical and electronic equipment, please contact your dealer or supplier for further information.

8.2 Disposal in Countries Outside the European Union

The symbol has only validity in the European Union. If you wish to discard these items, please contact your local authorities or dealer and ask for the correct method of disposal.

8.3 Battery Symbol

The WEEE symbol can be supplemented with one or more chemical symbols to indicate what kind of battery is used in the product. The chemical symbols will then be placed under the black rectangle.

9 References

The references in this document are labeled with a lower case letter within this kind of brackets { }.

- {a}** MoCA Access™ 2.5 standard.
mocalliance.org
- {b}** IEEE 802.1Q - The IEEE Standard for Local and Metropolitan Area Networks—Bridges and Bridged Networks.
standards.ieee.org/standard/802_1Q-2018
- {c}** RoHS 2 Directive 2011/65/EU - This is a directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
ec.europa.eu/environment/waste/rohs_eee
- {d}** EN 60728 - The Cable networks for television signals, sound signals and interactive services.
ec.europa.eu/standards/iec-60728
- {e}** EN 50083-1 - Cabled Distribution Systems for Television, Sound and Interactive Multimedia Signals Part 1: Safety Requirements.
standards.globalspec.com/std/178814/EN50083-1
- {f}** in:xtnd™ Control Software User Manual - A detailed description of the web interface and the setup of the *Controller*.
- {g}** IEEE 802.1p is the name of a task group active from 1995 to 1998 and responsible for adding traffic class expediting and dynamic multicast filtering to the IEEE 802.1D standard. The group's work was not published separately but was incorporated into a major revision of the standard, IEEE 802.1D-1998, which got later on incorporated into IEEE 802.1Q-2014 standard. See **{b}** above. The work also required a short amendment extending the frame size of the Ethernet standard by four bytes which was published as IEEE 802.3ac in 1998. See **{i}** below.
- {h}** SFF-8472 standard - Specification for Management Interface for SFP+
members.snia.org
- {i}** UL 94 - This is a standard for tests for flammability of plastic materials for parts in devices and appliances; Underwriters Laboratories.
V-0 - burning stops within 10 seconds on a vertical specimen; drips of particles allowed as long as they are not inflamed.
standardscatalog.ul.com/standards/en/standard_94_6
- {j}** IEEE 802.1ad - This was an Ethernet networking standard informally known as "QinQ" and was an amendment to IEEE standard 802.1Q-1998. The 802.1ad was incorporated into the base standard 802.1Q in 2011.
- {k}** IEEE 802.3 - This is a working group and a collection of IEEE standards produced by the working group defining the physical layer and data link layer's media access control (MAC) of wired Ethernet.
standards.ieee.org/standard/802_3-2018
- {l}** IEEE 802.3ac - IEEE Standard for information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) frame extensions for Virtual Bridged Local Area Networks (VLAN) tagging on 802.3 networks.
standards.ieee.org/standard/802_3ac-1998
- {m}** IEEE 802.3u - IEEE Standards for Local and Metropolitan Area Networks: Supplement - Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100Mb/s Operation, Type 100BASE-T (Clauses 21-30).
standards.ieee.org/standard/802_3u-1995
- {n}** EN 55032:2015 - Electromagnetic Compatibility of Multimedia Equipment.
e.g. rfemcdevelopment.eu/en/emc-emi-standards/en-55032-2015
- {o}** EN 300386 V2.1.1 - Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements; Harmonised Standard covering the essential requirements of the Directive 2014/30/EU.
etsi.org/.../en_300386v020101p
- {p}** EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.
See **{c}** above.
- {q}** EN 55035:2017 - Radio equipment Directive (2014/53/EU) - Electromagnetic compatibility of multimedia equipment - Immunity requirements CISPR 35:2016 (Modified).
ce-marking.help/directive/radio-equipment/standard/5/en-550352017#
- {r}** EN 62368-1:2014 - Low voltage (LVD) Directive (2014/35/EU) - Audio/video, information and communication technology equipment - Part 1: Safety requirements.
ce-marking.help/directive/low-voltage-lvd/standard/1639/en-62368-12014

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- {s}** FCC Class A part 15 of the FCC Rules
ecfr.gov/...47.1.15&rgn=div5#sp47.1.15.b
- {t}** CAN ICES-3(A)/NMB-3(A) - Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement.
ic.gc.ca/eic/site/smt-gst.nsf/eng/sf00020.html
- {u}** WEEE Directive 2012/19/EU - This is the European Community Directive on Waste Electrical and Electronic Equipment (WEEE) which, together with the RoHS Directive 2011/65/EU, became European Law in February 2003.
ec.europa.eu/environment/waste/weee/index_en.htm
and
eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012L0019
- {v}** Battery Directive 2013/56/EU - This is an amendment to the Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators.
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013L0056>

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