

IQ4NC Controllers



Description

The IQ4NC enables Trend networks on different media (either Ethernet, Trend current loop, or MS/TP) to be joined together in various configurations. It provides 4 virtual CNCs which allow supervisors or tools on the Ethernet network to connect to the Trend system.

The IQ4NC/00 has no I/O channels, but IQ4NC/12 has 12.

Note that the IQ4NC is based on IQ422 hardware and firmware IQ422 functionality is described in the IQ422 Data Sheet (TA201260); this data sheet describes the additional functionality of the IQ4NC.

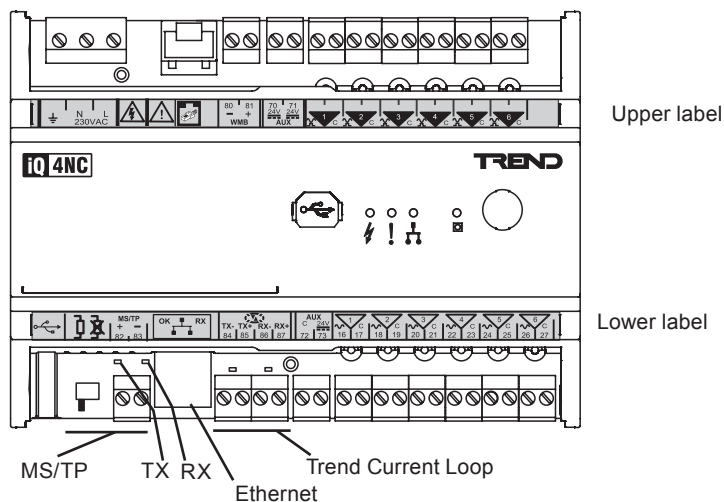
Features

- Trend system interface with MS/TP trunk (e.g. IQecos)
- BACnet over MS/TP
- Extend Trend network from Ethernet to Trend current loop
- BACnet over IP
- Communication mode configuration facilitated by IQ web pages
- INC alarm forwarding (e.g. enabling IQeco alarms to be forwarded to an IP address)

Physical

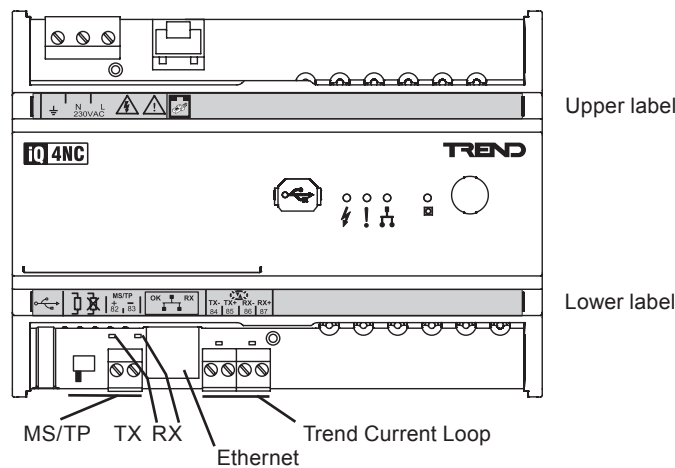
This section highlights features relevant to the NC functionality. For physical dimensions and other details see the IQ422 Data Sheet (TA201260).

IQ4NC/12

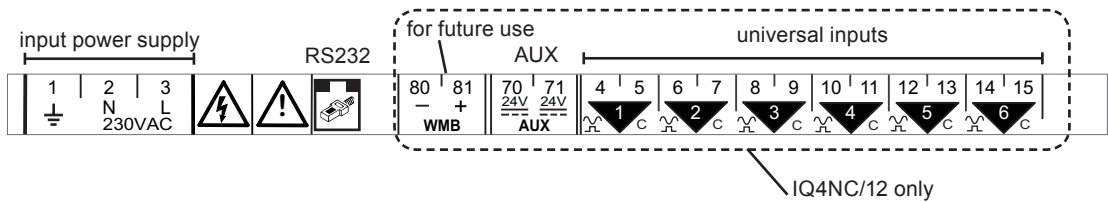


Physical (continued)

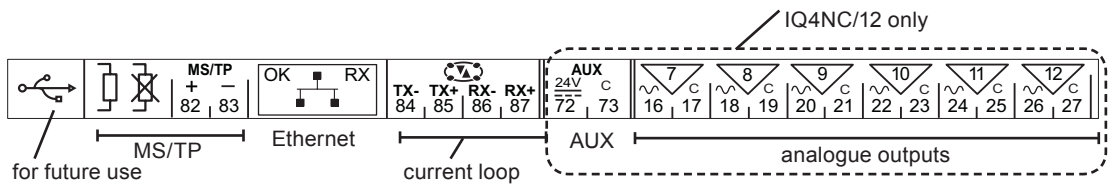
IQ4NC/00



Terminal Labels
Upper Label



Lower Label



FUNCTIONALITY

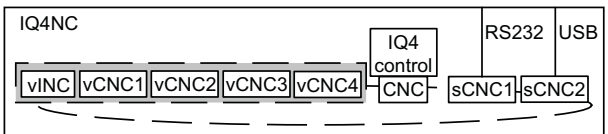
The IQ4NC's functionality can be divided into four sections: System, Hardware, Firmware, and Strategy.

SYSTEM

The IQ4NC includes both /BAC/ (Bacnet) and /LAN/ (Trend current loop) features as well as additional MS/TP network capability. It can be configured to operate in one of four modes:

- Ethernet to MS/TP (default)
- Trend Internetwork to MS/TP
- Ethernet Trend Lan
- Ethernet Trend Internetwork

The IQ4NC's internal network structure is shown below:



vINC: The IQ4NC has a permanent virtual INC (internetwork node controller) unlike the basic IQ4 which only has a vINC if its CNC is the lowest address on its Lan. The vINC always has a Lan to connect to the internetwork so the IQ4NC cannot join another Trend Lan on Ethernet. The vINC has the standard INC address of 126 on its local Lan.

vCNC1, vCNC2, vCNC3, vCNC4: There are 4 virtual CNCs, so that if a supervisor is connected to the IQ4NC, an engineering tool can also be connected by way of another virtual CNC.

CNC: This is the CNC for the IQ4 controller.

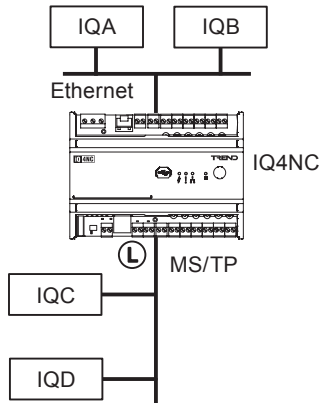
sCNC1: This supervisor CNC is only present if the local supervisor port (RS232) is set to a non-zero address. This enables a supervisor, tool, or display panel to be connected using the RS232 port.

sCNC2: This supervisor CNC is only permanently present if the local engineering port (USB) is set to a non-zero address. It enables a supervisor, tool, or display panel to be connected by way of the USB port. If the IQ4NC's USB port address is set to 0 (default), a supervisory CNC (sCNC2) at address 125 is dynamically created while a PC running SET is connected. When the PC is removed the sCNC times out and no longer exists on the network.

Ethernet to MS/TP

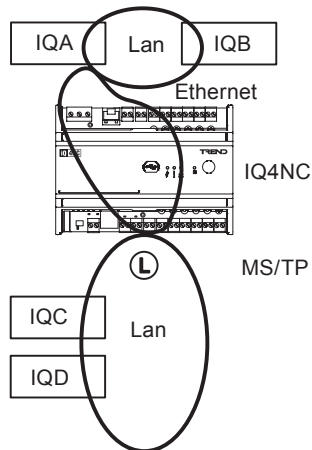
When in this mode the IQ4NC acts as an interface between an internetwork on Ethernet, and a Lan on an MS/TP network. This is the default mode of operation.

Physical



The diagram above shows the physical connection of the IQ4NC with IQA and B Ethernet devices, and IQC and D, Trend MS/TP devices (e.g. IQeco).

Schematic

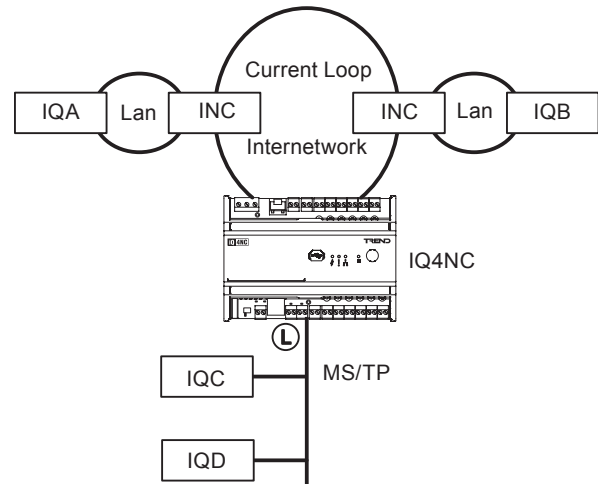


The diagram above assumes IQA and B are on the same Lan and IQA has taken the INC role. IQC and D have formed a Lan on MS/TP. The IQ4NC provides the MS/TP Lan INC which forms an internetwork with the Ethernet Lan INC in IQA. The IQ4NC's local Lan, (L), is the MS/TP Lan.

Trend Internetwork to MS/TP

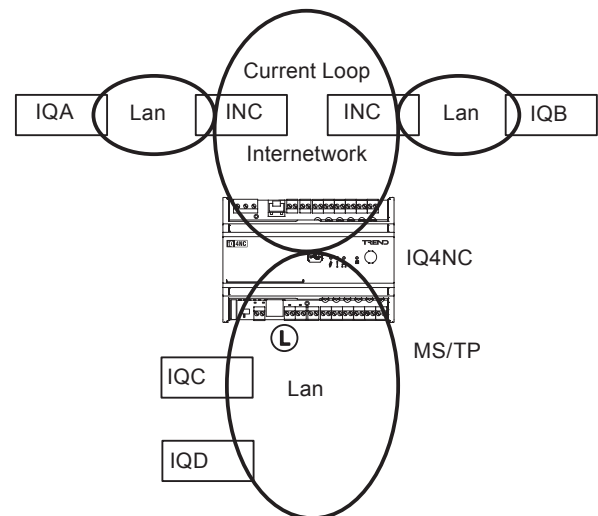
When in this mode the IQ4NC acts as an interface between an internetwork on a Trend current loop network and a Lan on an MS/TP network.

Physical



In the diagram above IQA and B are on separate current loop Lans each with their own INC, which are connected together by a current loop internetwork. IQC and D are Trend MS/TP devices connected to the IQ4NC by the MS/TP trunk.

Schematic

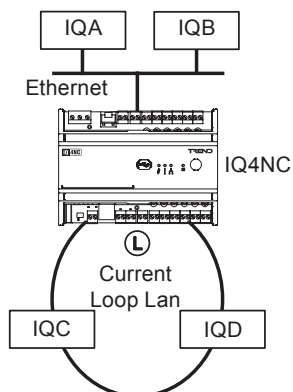


In the diagram above IQC and D form a Lan on MS/TP along with the IQ4NC INC. The IQ4NC INC joins the internetwork. The IQ4NC's local Lan, (L), is the MS/TP Lan.

Ethernet to Trend Lan

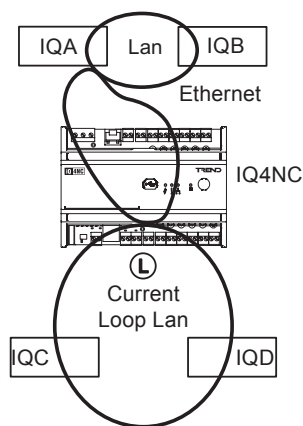
When in this mode the IQ4NC acts as an interface between an internetwork on Ethernet and a Lan on the Trend current loop network.

Physical



The diagram above shows the physical connection of the IQ4NC with IQA and B Ethernet devices, and IQC and D, Trend current loop Lan devices (e.g. IQ1, IQ2, IQ3/LAN, IQ4/LAN).

Schematic

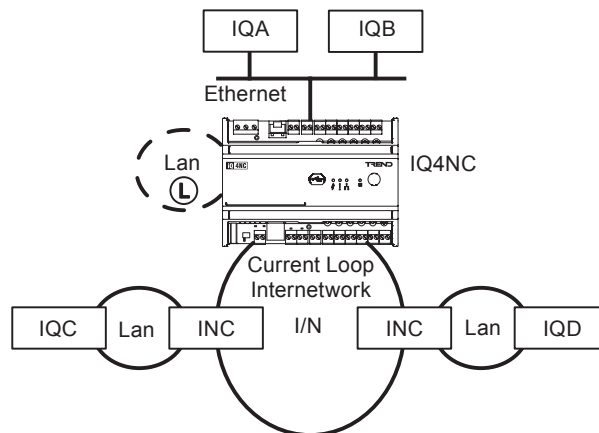


The diagram above assumes IQA and B are on the same Lan and IQA has taken the INC role. IQC and D have formed a Lan on current loop. The IQ4NC provides the current loop Lan INC which forms an internetwork with the Ethernet Lan INC in IQA. The IQ4NC's local Lan, \odot , is the current loop Lan.

Ethernet to Trend Internetwork

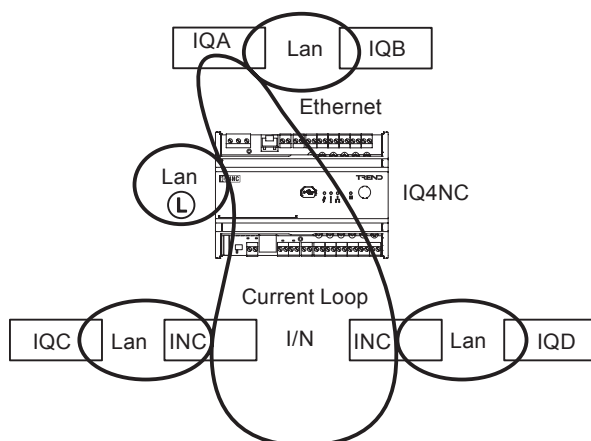
When in this mode the IQ4NC extends the internetwork on Ethernet, onto the Trend current loop network

Physical



In the diagram above IQA and B Ethernet devices, and IQC and D, Trend current loop Lan devices (e.g. IQ1, IQ2, IQ3/LAN, IQ4/LAN).

Schematic.



The diagram above assumes IQA and B are on the same Lan and IQA has taken the INC role. IQC and D are on separate current loop Lans each with their own INC, which are connected together by a current loop internetwork. The IQ4NC forms an internetwork from the current loop Lan INCs and the Ethernet Lan INC in IQA. It also has its own virtual Lan \odot , with an INC on the internetwork.

Trend on MS/TP

IQecos can operate on the MS/TP trunk and will try to form network without an IQ4NC. As a result attribute type IC comms set up for communication between controllers will operate successfully, and any pre-configured IQeco will run its control strategy. Although BACnet comms will work with default settings, the IQ4NC and SET can be used temporarily to set up addresses (e.g. avoid duplicate addresses) and other parameters, and then be removed. The IQ4NC should be in either Ethernet to MS/TP or Trend Internetwork to MS/TP mode.

If a IQ4NC is in either of these modes and IQecos 'out of the box' are connected as a system they will form a network. The IQ4NC will provide the Lan address for the IQecos, and the controllers will all be accessible to a supervisor or tool using the IQ4NC's Ethernet connection or RS232 or USB serial port connections, although there is a remote chance of an address clash as described in the IQeco Configuration Manual, (TE201089).

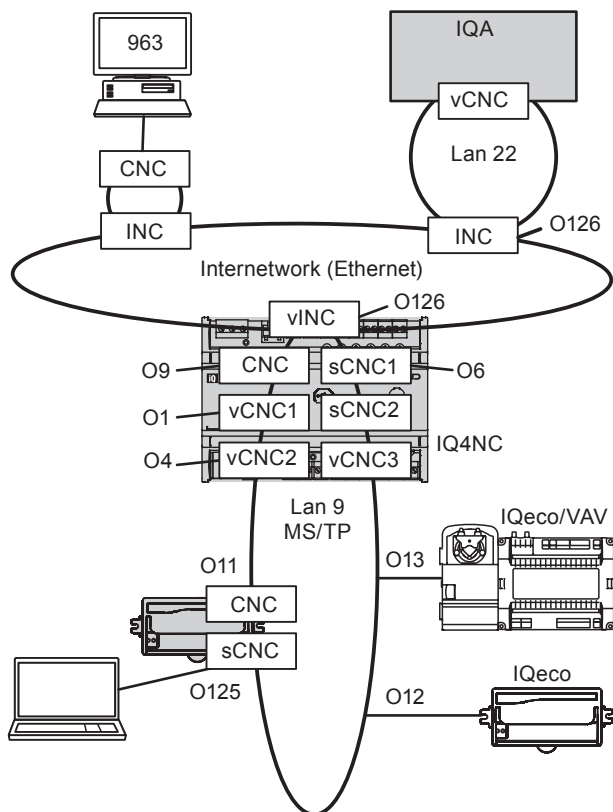
The IQ4NC will form an internetwork on either Ethernet with any other Ethernet INC type devices (e.g. 3xtend EINC L) or current loop with any other current loop INC type devices (e.g. EINC).

The vINC of the IQ4NC connects to the internetwork on either Ethernet or current loop on one side, and to an MS/TP Lan on the other. The IQecos connect to MS/TP, and together with the IQ4NC's internal nodes form a local Lan. The address of the IQ4NC's vINC on this Lan is fixed at 126 (i.e. conventional INC address on its Lan), and the Lan number of the Lan is set in the IQ4NC (Address module/Local Lan).

The IQ4NC's local Lan is the MS/TP Lan, its vINC is always present, and there cannot be another Trend Ethernet Device (e.g. IQ34) on the same Lan as the IQ4NC.

There can be only one Lan on the MS/TP trunk. There cannot be another IQ4NC on the same MS/TP trunk.

Example



This example shows the IQ4NC interfacing between an internetwork which can be on either Ethernet or current loop.

This example uses the IQ4NC's default address settings (address 9 on Lan 9). The IQ4NC's vCNCs (vCNC1, and vCNC2) take addresses 1 and 4 respectively. The sCNC1 has been enabled by changing its address from zero to 6.

The 963 is connected over the internetwork. IQA is on a separate Lan (Lan22) connected over the internetwork.

The IQ4NC's MS/TP trunk has 3 IQecos one of which has a Laptop connected to its local engineering port (USB) which has an sCNC dynamically created at address 125.

The IQecos' addresses are set in the factory on a rolling basis, (range 11 to 119). If required they can be changed. In the above example they have addresses 11 to 13.

The IQecos are all on Lan 9; the Lan number has been set up in each IQeco by the IQ4NC.

The IQecos can perform IC Comms with each other and with the other IQs including the IQ4NC; IC Comms with IQA are by way of the IQ4NC's INC over the internetwork.

The IQecos can send alarms (Trend Lan type) to the 963 via vCNC1. If the 963 is not permanently connected (i.e. temporary - TCP dial up) then the alarm can be sent using INC alarm forwarding see 'INC Alarm Forwarding'.

Both PCs (963 and laptop) can use tools (e.g. SET) or supervisors to communicate with the IQecos, and perform upload/download of strategy files.

The BACnet MAC address of an IQeco will always be the same as its Trend device address. The IQ4NC has a default MAC address of zero and a default BACnet network number equal to the Trend Lan number but both of these may be changed in the IQ4NC's BACnet MSTP network module.

The IQ4NC's, and IQeco's BACnet Device Instances will default to a function of their Trend Lan Number and device addresses (Lan number x1000+Device Address), but may be changed in the devices' BACnet Application network modules.

Other non Trend MS/TP master and slave devices can be added to the trunk, but their presence may compromise the physical network loading and bandwidth. Care must be taken to avoid a BACnet MAC address clash. Master devices are required to use BACnet MAC addresses in the range 0 to 127, and slave devices are required to use BACnet MAC addresses 128 to 254.

Note if communicating with an IQeco through a BACnet router, communication with the IQeco is only possible using BACnet protocol. Trend communications will not work unless the router is an IQ3/BINC or IQ4NC.

Trend Lan Network Alarms

The IQ4NC will forward its local Lan network alarms to the specified alarm group set up in the appropriate network module. In the special case of Ethernet to Trend Internetwork mode the local virtual Lan cannot produce reportable alarms.

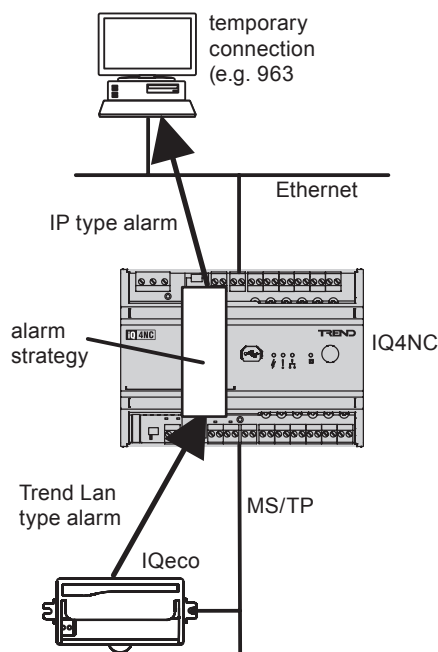
INC Alarm Forwarding

INC Alarm Forwarding enables the IQ4NC to forward IQ controller alarms either to the IP address of a remote Trend supervisor making temporary connection to the site (TCP/IP dial up) or to an email address.

INC alarm forwarding is a feature of a permanent vINC which is present in both IQ4NC and IQ3/BINC. It satisfies a similar requirement to that provided by the EINC and 3xtend/EINC L when the vCNC is set up in alarm mode.

This feature can be used by any Trend IQ controller but is particularly useful for controllers which do not have direct Ethernet access or do not have IP Address or Email alarm destination types, such as IQ1, IQ2, IQL, IQeco, IQ3/LAN, IQ4/LAN.

The IQ controller will send the alarms to be forwarded to the IQ4NC which will receive the alarms using the receiving network module (i.e. BACnet MSTP, IQ Lan, or Ethernet IP). The IQ4NC controller must have the alarm group parameter set up in this network module. The network module will then place the alarm in the specified alarm group for processing to the required IP or email address in the normal manner by the Alarm Group, Route, and Destination modules. Care should be taken in the configuration of the alarm format in the sending IQ controller as only certain formats are supported for different destinations; full details of the forwarded alarm type and format are given in the IQ4 Configuration Manual (TE201263).



The diagram above shows an IQeco sending an alarm to the IQ4NC on its local Lan which is forwarding it to a 963.

Using a Remote IQ4NC: The ability to send the alarms to a remote IQ4NC enables remote IQ controllers to make use of the IQ4NC's alarm strategy to forward alarms (or it could be in order to send alarms to a different destination than that set up on its local IQ4NC).

Alarm from Current Loop Lan being forwarded: Alarms from a current loop Lan will be initiated by IQ1, IQ2, IQ3/LAN or IQ4/LAN; they will be of Trend Alarm type and so need to be forwarded as Email, or IP (if to be received by a device making a temporary Ethernet connection).

EINC replacement by IQ4NC: A specific example of alarms from a current loop Lan being forwarded by an IQ4NC is where an EINC is being replaced by an IQ4NC. The EINC can have a vCNC set to alarm mode for alarm forwarding; the IQ4NC controller address should be set to the address of this vCNC so that the alarms will be received for forwarding by the IQ4NC without having to change destination addresses in the initiating IQs.

Network Alarms and Alarms for forwarding: A network module alarm group is also used to handle network type alarms from that particular network, so both alarms for forwarding and appropriate network alarms will be forwarded through the IQ4NC's alarm strategy.

Alarm forwarding to a vCNC: Alarm forwarding as Trend Lan type alarm is not supported. If this is required the alarms can be targeted directly to that vCNC rather than using alarm forwarding.

Target Address for Alarms to be forwarded: Two alarm address options are available for sending alarms to an IQ4NC:

- For all IQ1, 2, 3, and 4 (pre v3.2) controllers this will be the IQ4NC's controller address on its own Lan number. This option provides benefits to existing sites e.g. replacing an EINC with an IQ4NC.
- For all future projects using IQeco, IQ2, IQ3, IQ4 (v3.2 or greater) controllers, this will be the IQ4NC's controller address or address 126 both on its own Lan number. This enables 126 to be used as standard without knowing the IQ4NC's specific address.

Note that there are various ways of addressing the Lan number of a local IQ4NC depending on the controller type, and also that although address 126 can be set up in SET, it is not always configurable using web pages, configuration mode, or text comms. These concerns are covered by the recommended address settings given in the table below.

IQ	IQ4NC on Local Lan		IQ4NC on Remote Lan	
	Outstation	Lan	Outstation	Lan
IQeco (Pre v2.2)	126	IQ4NC's Lan Number	126	IQ4NC's Lan Number
IQeco (v2.2 or greater)	126	0 or IQ4NC's Lan Number		
IQ4 - (v3.2 or greater)	126	126		
IQ1/2/3, IQ4 (pre v3.2)	IQ4NC's Controller address	0	IQ4NC's Controller address	

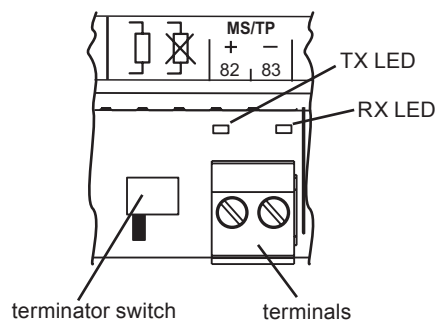
For example an IQ2 sending its alarm to an IQ4NC on its local Lan will send it to the IQ4NC controller address on Lan 0.

HARDWARE

The standard IQ4NC hardware is covered in the IQ422 Data Sheet, (TA201260). The additional MS/TP interface is described in this document.

MS/TP Provision

The IQ4NC is supplied with MS/TP terminals, terminator switch, and LEDs.



MS/TP Terminals: The MS/TP terminals are 2 wide. Terminal 82 is positive, terminal 83 is negative.

MS/TP Terminator Switch: The terminator switch is used to switch the IQ4NC's integral 120 ohm terminating resistor in or out of circuit.

The MS/TP trunk should be terminated at each end. The IQ4NC facilitates this with a terminator which can be switched in or out. To use the terminator the IQ4NC must be at one end of the trunk with the terminator switched in. A 120 ohm resistor must be connected across the MSTP terminals of the MS/TP device at the other end as described in the "MS/TP Trunk" section of this document.



MS/TP LEDs

TX: This yellow LED is illuminated when the interface is transmitting, and extinguished when it is receiving. It normally flashes as communications proceed.

RX: This yellow LED is illuminated when the interface is receiving, and extinguished when it is transmitting. It normally flashes as communications proceed.

MS/TP Trunk

The IQ4NC in Ethernet to MS/TP or Trend Internetwork to MS/TP modes behaves as a master on the MS/TP trunk. MS/TP (master-slave token passing) is based on the two wire RS485 network. It can operate at speeds from 9.6 to 76.8 kbps. 76k8 baud is recommended for best performance. The baud rate is set in the IQ4NC's BACnet MSTP network module and the IQecos automatically set their baud rates to match. The baud rates of all devices on the trunk must be the same.

The MS/TP trunk should be wired as a straight bus (not loop or star). Use tinned copper, screened, twisted-pair cable with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and screen shall be less than 200 pF per meter (60 pF per foot). Foil or braided screens are acceptable. The maximum recommended length of an MS/TP segment is 1200 meters (4000 feet) with AWG 18 (0.82 mm² cross sectional area) cable.

The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485. Details of recommended cable are given in the Trend TP Cable Data Sheet (TA200541).

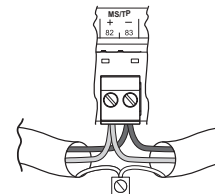
All MS/TP devices must have their power supply neutral or ground terminal connected to earth, in conjunction with normal safety wiring.

The IQ4NC provides network biasing (470 ohms); a maximum of two devices on the network can provide network biasing.

Matched terminating resistors ($\pm 1\%$, ¼ Watt, range 100 to 130 ohms) are required as shown above.

Up to 3 repeaters may be used. Each MS/TP segment must have a single point screen ground. Do not ground the MS/TP screen using a controller terminal. Do not ground both ends of the screen.

Screen should be continuous; at connecting points, tie the screen through an additional terminal (not supplied).



Additional terminal (not supplied)

Failure to comply with these practices will result in significant impairment of the communication performance.

For detailed information about wiring the MS/TP trunk see the IQ4NC Controller Installation Instructions -mounting (TG201264).

There may be the IQ4NC with up to 64 IQecos or other manufacturer's devices on the MS/TP trunk.

A separate limitation is that the MS/TP segment supports up to 32 'unit' loads. The IQ4NC presents a ¼ BACnet 'unit' load (ref. EIA-485), as does the IQeco; other manufacturer's devices may have different unit loads.

FIRMWARE / STRATEGY

The descriptions of the firmware and strategy for the IQ4NC are covered in the IQ422 Data Sheet (TA201260), other than it having a BACnet MSTP network module.

COMPATIBILITY

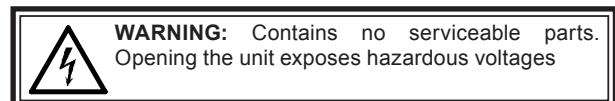
See the IQ422 Data Sheet (TA201260) for general compatibility any differences are shown below.

Supervisor: 963 v3.30, IQView4 v1.4

Tools: SET SET 6.9 is required to configure IQ4NC specific parameters.

FIELD MAINTENANCE

The IQ4NC controller requires no routine maintenance.

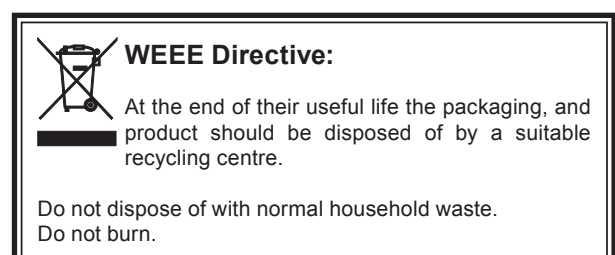


DISPOSAL

COSHH (Control of Substances Hazardous to Health - UK Government Regulations 2002) ASSESSMENT FOR DISPOSAL OF IQ4NC controllers.

RECYCLING

All plastic and metal parts are recyclable. The printed circuit board may be sent to any PCB recovery contractor to recover some of the components for any metals such as gold and silver.

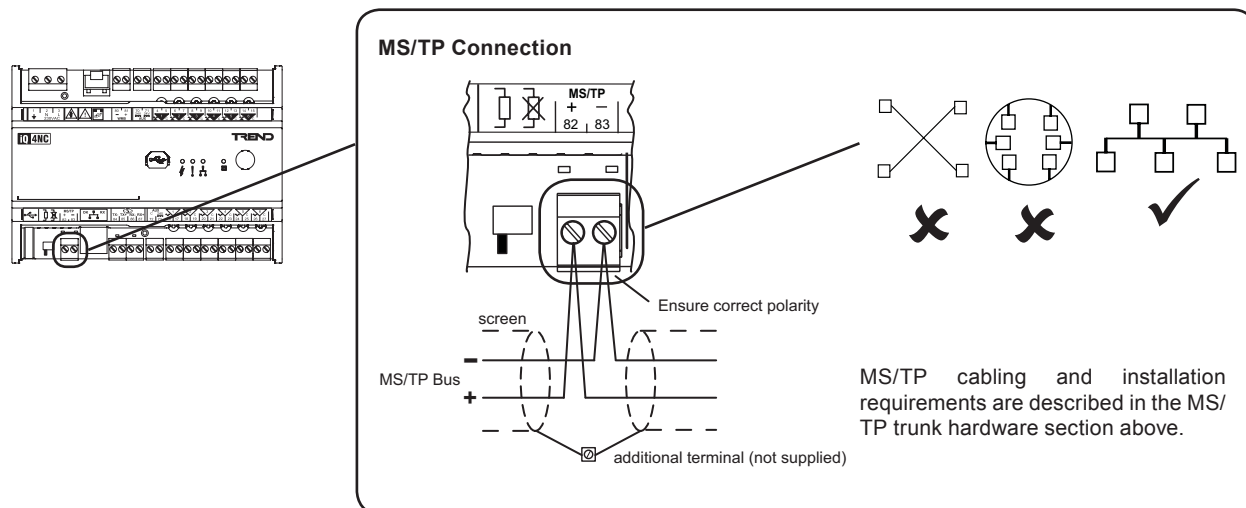


INSTALLATION

The IQ4NC installation follows the same process as that described in the IQ422 Data Sheet except for the additional steps required for the MS/TP interface and for configuring the communication mode. A full description of installing the unit is given in the IQ4NC, IQ422 Installation Instructions - Mounting (TG201264) and IQ4NC, IQ422 Installation Instructions - Configuration (TG201265).

CONNECTIONS

The connections are described in the IQ422 Data Sheet except for the MS/TP connections as shown below.



ORDER CODES

IQ4NC/00/230	:IQ4NC with zero I/O channels with 230 Vac supply
IQ4NC/12/230	:IQ4NC with 12 I/O channels with 230 Vac supply
IQ4NC/00/24VAC	:IQ4NC with zero I/O channels with 24 Vac supply
IQ4NC/12/24VAC	:IQ4NC with 12 I/O channels with 24 Vac supply

SPECIFICATIONS

See the IQ422 Data Sheet (TA201260) for specifications except for MS/TP interface as below.

ELECTRICAL

Input power supply voltage

IQ4NC/00/230	230VAC $\pm 10\%$ 50/60 Hz at up to 20 VA
IQ4NC/12/230	230VAC $\pm 10\%$ 50/60 Hz at up to 44 VA
IQ4NC/00/24VAC	24VAC $\pm 10\%$ 50/60 Hz at up to 20 VA
IQ4NC/12/24VAC	24VAC $\pm 10\%$ 50/60 Hz at up to 28 VA

MS/TP INTERFACE

MS/TP Bus

Distance	:Dependent on cable type and wire gauge as specified in EIA-485.
Load	: $\frac{1}{4}$ BACnet 'unit' load
Signalling	:RS-485 signalling transceiver standard
Baud rate	:9k6 to 76k8 baud.
Termination	:100 to 130 ohms matched each end
Terminator	:Integral terminator 120 ohms. Can be switched on or out.

Connectors

RS485	:2 wide 2 part screw terminals for 0.5 to 2.5 mm ² cross section area (14 to 20 AWG) cables.
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LEDs

TX	:Yellow LED
RX	:Yellow LED

Version

Firmware	: IQ4. v3.2
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Trend Control Systems Limited

Albery House, Springfield Road, Horsham, West Sussex, RH12 2PQ, UK. Tel:+44 (0)1403 211888 Fax:+44 (0)1403 241608 www.trendcontrols.com

Trend Control System USA

6670 185th Avenue NE, Redmond, Washington 98052, USA. Tel:(425) 869-3900 Fax:(425) 869-8445 www.trend-america.com