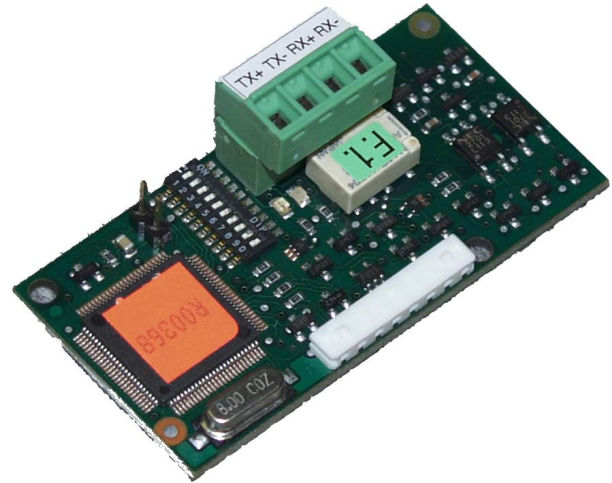# IQPCO/INTERFACE CARD
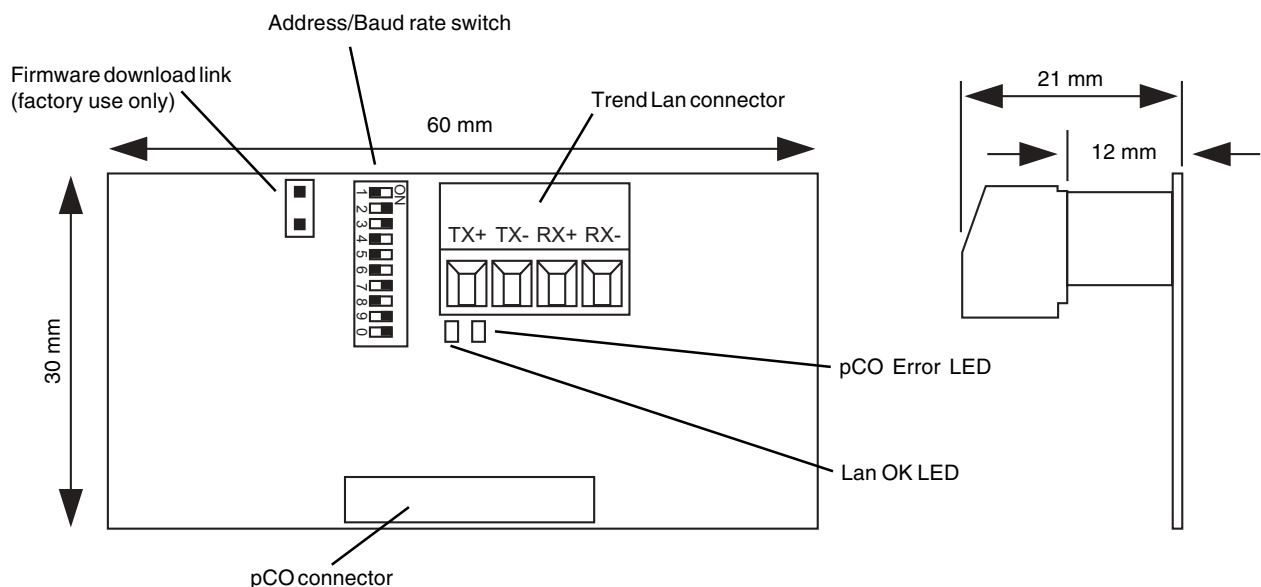# Carel pCO Interface

Carel pCO Interface

Description

The Carel pCO interface is a small pcb which can be plugged into a Carel pCO controller to provide it with Trend network capability. The interface needs to be configured in order that the required Carel controller variables are linked to appropriate Trend parameters; these then become accessible via the Trend network using standard Trend (text) communications. The interface provides CNC functionality.

Features

- Compatible with pCO^C, pCO^1, or pCO^2 controllers
- Flexible number of configuration modules
- Peer to peer communications (IC Comms)
- Configuration software available (PCO Tool)
- Suitable for field installation
- Display and directory modules

Physical

Firmware download link (factory use only)

Address/Baud rate switch

Trend Lan connector

60 mm

30 mm

TX+ TX- RX+ RX-

21 mm

12 mm

pCO Error LED

Lan OK LED

pCO connector

FUNCTIONALITY

The Carel pCO interface board plugs into the Serial Card slot on the Carel pCO^C, pCO^1, and pCO^2 controllers. These controllers are fully configurable using Carel software tools. The resultant Carel variables are linked to Trend variables using the interface configuration tool (PCO Tool), and the PCO tool configuration file sets up the required Trend variables and their linking in the interface when it is downloaded. The interface provides the Carel controller with Trend network capability. The linked Trend variables become accessible to other Trend networked devices by using terse text communications.
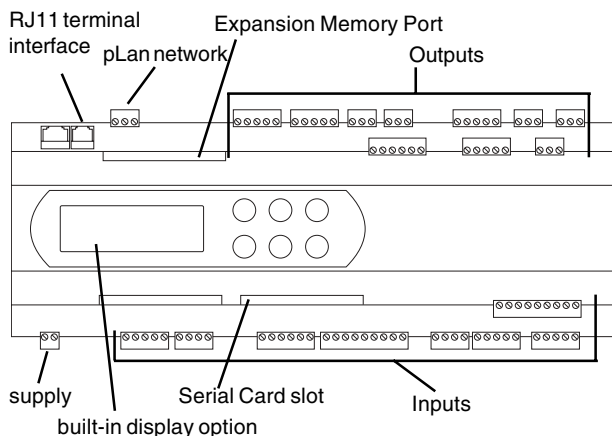
SYSTEM

Carel Controllers

The Carel series of controllers are microprocessor based electronic controllers suitable for HVACR applications. The different types of controller vary in memory size, and other features as summarised below.

pCO^C: Bottom of range, board version, used by air-conditioning and refrigeration OEMs.

pCO^1: Mid-range, available in small and medium, DIN rail mounting containers, giving a range of I/O channel capability.

pCO^2: Top of the range, available in small, medium, and large DIN rail mounting containers, giving a range of I/O channel capability. An expansion bus allows the addition of further I/O channels. Has a built-in display option. Incorporates real time clock.


RJ11 terminal interface, pLan network, Expansion Memory Port, Outputs, supply, built-in display option, Serial Card slot, Inputs

Communications: In addition to the Carel pLan proprietary network, the controllers have Metasys, Modbus, external modem (including GSM with SMS) capability. Options can be added for LonWorks, Bacnet and TCP-IP.

Configuration: The controllers are configured using configuration software (Carel Easy Tools). The configuration file is then downloaded to the controller from the PC directly via an RS232/RS485 convertor connected to its RJ11 terminal interface. A 'programming key' can be used to carry the configuration data from controller to controller. It can be plugged into the controller's expansion memory port where it can both upload and download the configuration data.

Display Terminals: A variety of locally connected display terminal options are available. These can be used to display and adjust parameters

pCO Interface Board

Lan address, Baud rate, pCO connector, network connector, TX+ TX- RX+ RX-, pCO error LED, Lan OK LED
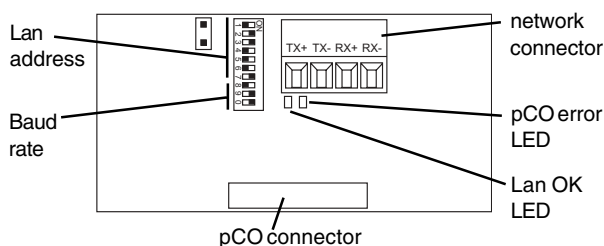
The pCO interface board (IQPCO) plugs into the serial card slot in the pCO controller. It connects to the Trend Lan. It has an on-board DIL switch to set the local address and baud rate on the Trend Lan. The Lan number has to be configured by terse text communications. It contains flash memory which is used to store its configuration information.

System

The PCO controller complete with the IQPCO interface board acts similar to a Trend IQ controller from a Trend system perspective.

Alarms terse text, Alarms terse text, IC COMMS, IQ, CNC LNC
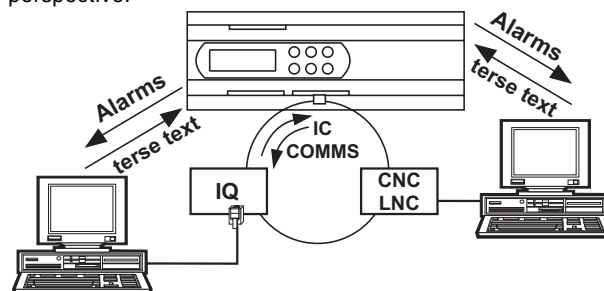
It will sit on a Trend Lan and communicate with other Trend Lan devices using terse text communications. This includes the short Inter-Controller Communications (used by NXNI and IQL) which enable peer to peer communications with other controllers.

A Network Display Panel (NDP) can monitor and control the interface via its display and directory modules. A PC or NDP can communicate with the interface over the Trend Lan via a CNC (or LNC), or via the virtual CNC provided by plugging locally into an IQ controller's local supervisor port (or NDP port).
The IQPCO is configured by running PCO Tool in the PC, creating the configuration file, and downloading it to the interface over the network.

HARDWARE
Board: The board is 30 x 30 x 12 mm with a single 8 pin in-line pCO controller edge connector socket. It can only plug into the controller one way (effectively polarised).

LED's: There are 2 LED's on the board:
> **Lan OK**   :(green) ON if network is operating. Flashes if invalid address set on baud rate switches (1, 2, 10, or >119)
> **pCO error**   :(red) Error in connection to pCO. Remove board and install again. Check pCO controller serial port configured correctly with the address set to one, and baud rate set to 19k2.

Power: From pCO connector, 30 mA current consumption

Address/Baud rate switch: The address on the Lan is set by poles 1 to 7 in range 1, 4 to 9, 11 to 119 and must be unique on the Lan. The baud rate is set by poles 8 to 10 in the range 1k2, 9k6, 19k2 and must match the other nodes on the Lan.

Network: The network connection is via a 4 wide 2 two part connector which facilitates connection of 2 wire cables. The standard Trend node features of Lan OK LED and network alarm generation are provided. There is a single double pole changeover network bypass relay which isolates the transmit side and relies on opto-isolators to isolate the receive side (note that the standard Trend Lan interface uses 2 double pole changeover relays).

STRATEGY

Although the control strategy exists in the pCO controller, the modules set up in the PCO Tool for linking to the Carel variables may cause some strategy functions to be implemented in the interface (e.g. knob limit and sensor input high and low limit checking). In this document we are referring to the strategy set up in the IQPCO.

Modules: The strategy consists of a number of functional blocks known as configuration modules. They are of two types, those with a fixed number of instances, and those which have a flexible number of instances appropriate to the Carel strategy and the need to access the Carel variables. If a flexible module is not used at all, then zero instances will be created. The maximum number of flexible modules that can be created is limited by the available memory (the PCO Tool gives an indication of memory left), except for sensor logs (10 maximum), and User module (1 maximum).

The following table lists the different types of configuration modules and the number of each type available in the IQPCO.

Module Type	Number	Module Type	Number
FIXED MODULES			
Address	1	Time	1
FLEXIBLE MODULES			
Sensor	F	Knob	F
Digital Inputs	F	Switch	F
IC Comms	F		
Plots (Sensor logs)	10 (max)	User Password	1 (max)
Display	F	Directory	F

Key: **F** flexible number of modules, from 0 instances to whatever number is created.

Linking: The module parameters can be linked to variables in the pCO controller strategy. Each Trend module parameter which can be linked to a Carel variable has an associated index parameter (normally lower case). If the index parameter is zero then the Trend module parameter is unlinked and may operate independently to the pCO controller strategy, but if the index parameter has a non-zero index number set up, then the Trend module parameter is linked to the Carel variable referenced by the index parameter. This linking is normally set up using PCO Tool.

e.g. Sensor module
      H - High alarm limit
      h - index for high alarm level

If **h=0**, the sensor value will be tested against the high alarm limit, **H**, by the IQPCO interface.
If **h=10**, the high alarm limit, **H**, is linked to the Carel variable with an index of 10, and the sensor level testing is assumed to be done in the Carel strategy.

Text Communications Parameters: The IQPCO modules have similar characteristics to the IQL controller modules as described in the Trend LonWorks Products Engineering Guide, TE200292 (these are based on the IQ modules described in the IQ Configuration Manual 90-1533).
The following parameters may be accessed via terse text communications. Please note that any changes to the strategy parameters should be followed by a text comms reset command, R(z=1), after all the changes are made, to commit the changes to flash memory and render them non-volatile to power interruptions - **Use with caution to preserve memory life** (see Memory Management section).
The following is a summary list of parameters which are described in the documents mentioned above (unless specifically detailed).

FIXED MODULES

Address Module
L Local address: (read only) set on DIP switches on IQPCO board. Normal Trend address range (1, 4 to 119 excluding address 10)
N Local Lan: (read/write, default 0) IQPCO Lan number - normal Trend address range (1, 4 to 119 excluding address 10)
D Identifier string: (read/write, default "IQPCO Interface") 20 character string
F attribute 2: (read/write, default "") 20 character string
G attribute 3: (read/write, default "") 20 character string
H attribute 4: (read/write, default "") 20 character string
A Alarm reporting address: (read/write, default 0) Device address on network to which alarms are sent.
Note that alarm destination node address must be in valid range on network - normal Trend address range (1, 4 to 119 excluding address 10) for alarms are to be transmitted
R Alarm outstation Lan number: (read/write, default 0) Lan number on network to which alarms are sent. In normal Trend address range (1, 4 to 119 excluding address 10)
C version information: (read only)
g generator: (read only) used for default PIN generation along with serial number below
s serial number: (read only - write once at factory) serial number unique to the particular IQPCO interface. Used to generate default PIN along with generator above.
y erase cycles remaining: (read only) A measure of the number of erase cycles remaining for backing up changes. A new IQPCO has 100 erase cycles, and as changes are consolidated they start to be used up (see Memory Management section below). When **y** reaches zero, a new card is required.
z backup changes: (read/write) setting z=1 will store all changes made to modules to flash memory.
Note that this command should be used with caution to prolong memory life - see Memory Management section below.
> strategy sequence steps: (read/write) The number of valid sequence steps currently being used. Set to zero to erase current configuration.
 # strategy running status: (read/write) 1 = strategy running, 0 = strategy not running

Time Module
H Hours: (read/write) range 0 to 23
N Minutes: (read/write) range 0 to 59
D Day of month: (read/write) range 1 to 31
M Month: (read/write) range 1 to 12
Y Year: two digit (read/write) range 0 to 99
W Day of week: (read/write) range 1 to 7
h index for hours: (read/write)
n index for minutes: (read/write)
d index for day of month: (read/write)
m index for month: (read/write)
y index for year: (read/write)
w index for day of week: (read/write)
Note that for each time module parameter the PCO has in fact three indices, a 'read from' variable, a 'write to' variable, and a parameter to trigger the write over the original variable. The IQPCO assumes the 3 indices are in sequence from the index referenced, so if h=10, then the value is read from 10, written to 11, and triggered to 12.

If the time module is completely unlinked (i.e. no indices are set up) then the IQPCO will operate a software clock and will synchronise to the Trend Lan time synchronisation messages.

However, if one of the time parameters is linked the IQPCO software clock is switched off and only the linked parameters will be updated. Under these circumstances a Trend Lan time synchronisation message will cause linked Carel variables to be synchronised. If the Carel time is to be master, this can be stopped by not exposing the trigger parameter in the Carel strategy (see PCO Tool section for detail), so the IQPCO is unable to write the changed time into the PCO.

FLEXIBLE MODULES

Sensor Module
$ Descriptive label: (read/write) 20 character string
% Units: (read/write) 4 character string
V Value: (read only)
v index for value: (read/write)
H High alarm level: (read/write, default 0)
h index for high alarm level: (read/write)
L Low alarm level: (read/write, default 0)
l index for low alarm level: (read/write)
M Alarm bits: (read only) 8 bits, 000000LH, where L=low alarm, H=high alarm
m0 index for high alarm status bit: (read/write)
m1 index for low alarm status bit: (read/write)
N Alarm enable bits: (read/write) 8 bits, 000000LH, where L=low alarm, H=high alarm

If the m0 or m1 index is not set up, the IQPCO sensor module will perform the appropriate alarm limit check (high or low) on the sensor value, and set the relevant M alarm bits appropriately. This limit checking is instantaneous, it has not any delay parameters.

Knob Module
$ Descriptive label: (read/write) 20 character string
% Units: (read/write) 4 character string
V Value: (read/write)
v index for value: (read/write)
T Top limit: (read/write)
t index for top limit: (read/write)
B Bottom limit: (read/write)
b index for bottom limit: (read/write)

The IQPCO will not let the knob value be set outside the top and bottom limits when written to by text comms. It will not perform this check when obtaining the value from the Carel controller via its index link.

Switch Module
$ Descriptive label: (read/write) 20 character string
S Status: (read/write) O or I
s index for status: (read/write)

Digital Input Module:
$ Descriptive label: (read/write) 20 character string
S Status: (read only) O or I
s index for status: (read/write)
R Required state: (read/write) O or I
E Alarm enable: (read/write) O or I

If the alarm is enabled, the IQPCO will perform instantaneous digital input alarm status checking (i.e. it has not a delay parameter).

Directory Module
$ Descriptive label: (read/write) 20 character string
R Parent directory module: (read/write, default=1)
P Pin level: (read/write) 0 to 99

Display Module:
I Item to display: (read/write) 3 character string e.g. S23
R Parent directory module: (read/write, default=1)
P Pin level: (read/write) 0 to 99

Plot Module
S Sensor number: (read/write, default=0)
P Plot interval: (read/write, default 1=15 mins) 0=1h, 1=15m, 2=24h, 3=1m, 4=5m, 5=10m, 6=20m, 7=30m, 8=6h)
The values are stored in RAM (volatile to supply interruptions or RAM erasure, R(>=1)) as a compact log. Each channel can store up to 80 readings on a rolling basis. If higher precision logs are required they should be charted using a supervisor (e.g. 962)
Note that there is a maximum of 10 plot (sensor log) modules

Inter Controller Communications Module
N Destination Lan: (read/write, default 0) normal Trend address range (1, 4 to 119 excluding address 10)

A Destination address: (read/write, default 0) normal Trend address range (1, 4 to 119 excluding address 10)
I Update interval: (read/write, default 0) in seconds
M Source item string: (read/write) 6 character string e.g. "S1(V)"
B Device attribute: (read/write, default 0) 0=no attribute, 1=identifier, 2=attribute 2, 3=attribute 3
E Destination module number: (read/write, default=0) 0=use source label attribute, 1 or greater=module number
T Destination module item: (read/write, default="") This defines the destination item type. If set to null string (no characters) sends value to same module type, otherwise can be set to **S** (sensor), **K** (knob), **I** (digital input), or **W** (switch)
S Significant change: (read/write, default = 0) This defines the amount by which an analogue value must change before an IC Comms is sent

The IQPCO IC Communications are similar to IQL IC Comms; the IQPCO can initiate Data To, Global to, Min, Max, Sum, and Average types to both IQs and IQLs. It can respond to Global to and min, max , sum , and average from IQs and IQLs, but only to Data to's from IQLs (not IQs).

User Module
P Pin number: (write only, default=0) 0 to 9999
L Level: (read/write, default=0) 0 to 99. If level set to zero there is no protection. If level set non zero parameters can't be changed unless PIN sent with message.

Note that there is a maximum of 1 user module.

Memory Management: The running strategy is contained in 8 kbyte of RAM. This is backed up to Flash memory. As changes are made to the strategy (i.e. by text comms), the changes are added to the Flash backup when the text command R(z=1) is given.
When the full 32 kbyte backup Flash is used up, the changes and original backup are consolidated, the backup Flash is erased, and the consolidated strategy is stored back into the first 8 kbyte of Flash. There are 100 such erase cycles permitted before the memory dies.

Strategy Download: When a strategy download occurs (e.g. as from PCO Tool), the text commands are first sent to stop the strategy running, R(#=0), and to erase RAM, R(>=0). The module data is then downloaded, followed by the backup command, R(z=1). The strategy is then turned on again by R(#=1). This process is transparent to the PCO Tool user.

Alarms: The IQPCO generates network alarms as follows (if alarm target address and Lan number are set up):
"IQL -Rem LAN From yyy on Lan xxx-
LAN Broken NKBK" - a break in Lan communications
LAN Changed NKCH"- a node has gone from or been added to the Lan
LAN OK NKOK"- Lan communications are restored
DUPLICATE ADDRESS NKDA" - The IQPCO's address is duplicated on the Lan
The IQPCO generates analogue input Sensor alarms to the alarm target (if set up) as follows: SENSOR FAIL occurred (OUTL), SENSOR FAIL cleared (COUT), INPUT ERROR occurred (READ), INPUT ERROR cleared (O/K). They are same format as IQ alarms.

Password: The IQPCO has a single programmable PIN number which will protect it from unauthorised changes. Once a PIN is set up, changes can't be made by text communications without the valid PIN being sent at the start of the message. If the PIN is forgotten, the user can contact Trend Technical Support quoting the generator number, and the serial number (see address module above). Trend Technical Support will supply a default PIN.

SOFTWARE

The IQPCO strategy should be configured using PCO Tool. This is part of an overall process in which the pCO controller is first configured in the PCO controller and then the list of available variables is passed to the PCO Tool so that the IQPCO can be configured.

PCO and IQPCO Configuration

The PCO controller is configured using Carel Easy Tools software. (Note that the pCO serial port should be configured with an address of one, and a baud rate of 19k2.) This produces the controller configuration file (*.BLK). A display information file (*.TRR) is also produced if the Carel variables are to be accessed via a display. (The *.TRR file is normally produced anyway as it enables the Easy Tools software to perform a strategy simulation test). Each Carel variable that is to be accessed via the IQPCO has to be exposed to the IQPCO by being connected to be read from or to be both read from and written to.
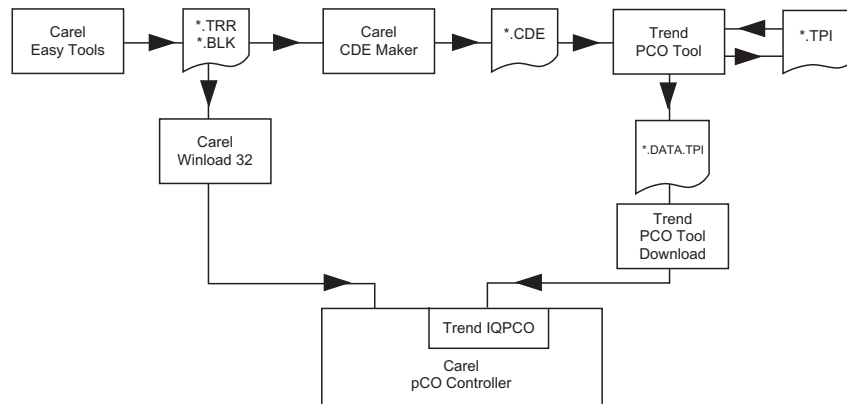
The .BLK file is downloaded to the pCO controller using the Carel Winload 32 software. This is done via an RS232/RS485 convertor connected to the RJ11 terminal interface.

The two files *.TRR and *.BLK are converted to a consolidated *.CDE file using the Carel CDE Maker software.

The *.CDE file contains the data about all the Carel variables and is used by the PCO Tool to create links to appropriate Trend parameters.

The PCO Tool creates a project file (*.TPI), and a downloadable data file (*.DATA.TPI). This is downloaded to the IQPCO via the Trend Lan using text communications.

PCO Tool
The PCO Tool is used to create the required Trend modules and their parameters and sequence steps in the IQPCO, and to link theTrend parameters to the Carel variables.
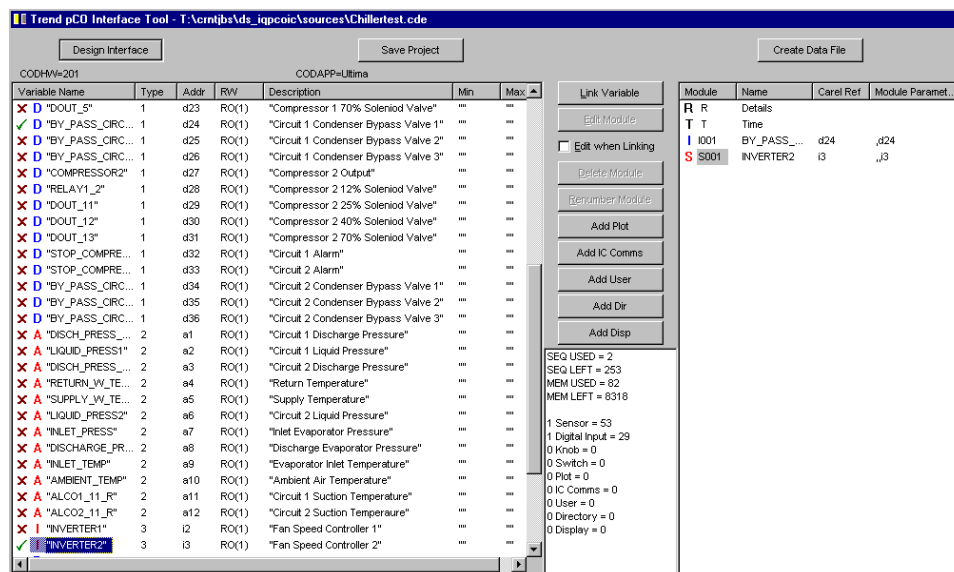
Once the .CDE file is loaded into the tool, the available files are displayed on the left hand side of the screen.

Variable Name: The first column, Variable Name, contains Linked status, Variable Type, and Variable Ident. The Linked status is indicated by a cross for unlinked, and a tick for linked. The variable types are D digital, A Analogue, I, Integer The variable ident is the variable name used in the pCO controller.
Type: This enumerates the variable type. A and I correspond to types 2, and 3, but D can be a normal digital, type 1, or a digital alarm, type 4.
1= digital, 2=analogue, 3=integer, 4=digital alarm
Address: This is the index to the PCO variable consisting of the variable type letter followed by a number (e.g. a21).
RW: This defines whether the Carel variable is read only (RO) or read/write (RW).

Description: This is the full label taken from the display file or copied from the variable ident if a display file was not created.
Min., Max.: These are the minimum and maximum values used in the PCO controller. They will get transferred across to the linked Trend parameter if appropriate (e.g. in a knob module)

Linking Automatically
The PCO variable is linked to a Trend parameter by either double clicking on the Carel variable or selecting it and then selecting the Link Variable button. The PCO Tool then creates an instance of the appropriate module and sets its index. It also copies across any relevant Min, Max limits.

The following relationship exits between Carel variables and the Trend modules:

Carel Variable			Trend Variable
Variable type	Type	RW	
A	2	RO	S (Sensor)
A	2	RW	K (Knob)
I	3	RO	S (Sensor)
I	3	RW	K (Knob)
D	1 or 4	RO	I (Digital Input)
D	1 or 4	RW	W (Switch)

Once the variable is linked, the linked Trend module appears on the right hand side.

For example, the Carel information:

I Time_Min_Off 3 i61 RW(3) Time Min Off "0" "600"

will produce a Trend module:

K 001 Time Min Off i61 ,,,i61,600,,0

From the above table a Carel variable **I type 3 RW** causes an instance of a knob module. So the next knob module, knob 1 is created. The Carel Description becomes the Trend Name. The index parameter i61 is set. The last item in the Trend side is the Module Parameters and it shows the index i61, and shows that the knob limits have been set from the Min. and Max. Carel parameters

Double clicking on the Trend module produces a dialogue box enabling the Trend module parameters to be viewed or edited.
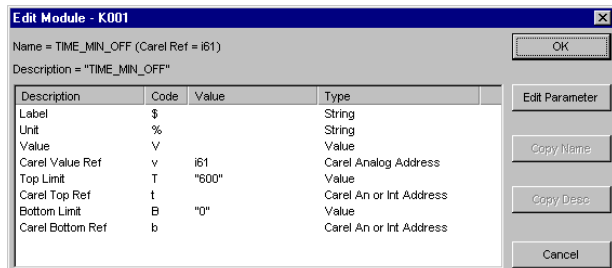
The Carel index (Carel Value Ref) has been set up and the Top and Bottom limits carried over.

Notice that the label has not been set up, but both name and description are shown at the top of the dialogue box and the user can choose which to use. The label is set up by selecting the label and then selecting either Copy Name, or Copy Description Buttons; an edit parameter box is then shown with the label set up for editing if required. Carel labels can be longer than Trend labels and may have to be shortened.

Linking Manually
In addition to the automatic linking, once the edit parameters box is open, the indices can be set up manually. This has to be done for module internal parameters that are to be linked to Carel variables. For example, for the knob, if there is a Carel variable corresponding to either the Top or Bottom Limit, it can be linked by selecting the appropriate index parameter (t or b) and selecting edit parameter. The Edit parameter box enables it to be linked to a Carel Analogue or Integer by keying in the index (e.g. a16).

Other Modules
The two fixed modules, Address and Time, are automatically created as the project is started. The other modules, Plot, IC Comms, User, Directory, and Display can be created by pressing the appropriate button.

Tallies
The current tallies are shown in the central column below the buttons. This shows the number of sequence steps used and remaining, and the memory used and remaining. The total memory of ~ 8 kbyte (8400 bytes) is reduced as the modules are created. Below this are the numbers of modules used of each type.

Project File
Selecting the Save Project button at the top of the display, causes all the project information to be saved in a .TPI file. This now contains all the linking information as well as the source .CDE data.
Work on this project could be continued by loading just the .TPI file.

Data File
Selecting the Create Data File button saves the strategy data ready for downloading. It saves as a DATA.TPI file.

Download Data
Selecting the Download Data button opens a box enabling the .DATA.TPI file to be selected. The target IQPCO Lan number and outstation address should then be entered.
If the target IQPCO has a password, and the .DATA.TPI file has a new password, then the PIN should first be disabled. This is done by selecting the Disable Pin button which enables the old PIN to be entered before disabling it. The new data file can then be downloaded.

Note that the .DATA.TPI file must be downloaded to a pCO controller with a strategy that matches the .BLK and .TRR files originally used.

COMPATIBILITY

|	
Supervisors:	94x series, 921, 962, Viewpoint+.
Utility software:	PowerTool, 822+/Toolbox version 6, WupDn, PCO Tool
Controllers:	It can communicate to other Trend IQ controllers using inter-controller communications.

DISPOSAL

COSHH ASSESSMENT FOR DISPOSAL OF IQPCO CONTROLLER. No parts affected.

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.
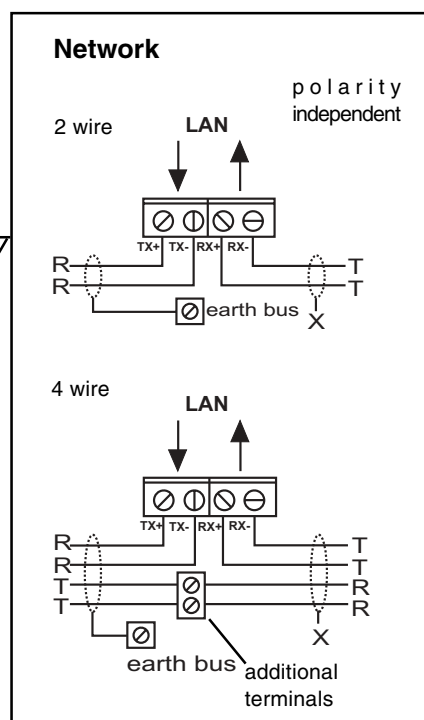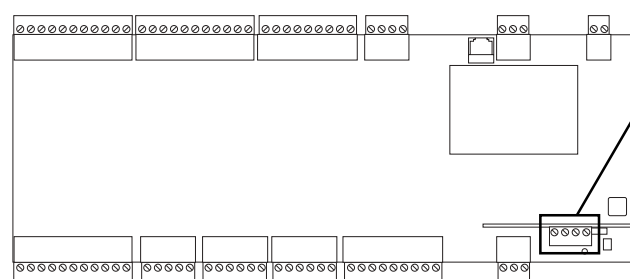
INSTALLATION

CONNECTIONS

pCO¹, pCO²
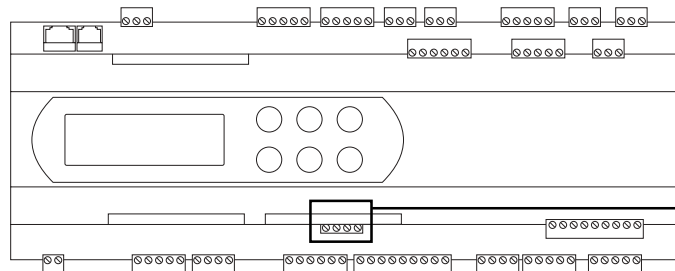
pCOᶜ

The IQPCO is installed into the pCO controller as follows:

> Power down pCO controller
> Remove Serial Card cover (pCO¹, pCO² only)
> Plug IQPCO into Serial Card slot.
> Place new Serial Card cover (supplied with IQPCO) in position (pCO¹, pCO² only)
> Connect the network
> Switch on power to the pCO controller
> Check LEDs
> Configure the IQPCO using PCO Tool
> Set up any IC Comms from IQ
> Set up any Text Comms from supervisor

This installation procedure, is covered by the IQPCO Installation Instructions, TG200597. Use of the PCO Tool is described in the PCO Tool Manual, TE200598

ORDER CODES

IQPCO/INTERFACE CARD   :Carel pCO Interface with plastic cover (to fit over Serial Card slot in pCO controller)

PCO Tool   :Software and manual is available from the Trend website and requires a valid licence to run.

SPECIFICATIONS

Electrical

Power supply : From pCO controller
Consumption : 30 mA
Network transmission : 20 mA serial 2 wire current loop, opto-isolated, polarity independent receiver, balanced transmitter.
Network distance : Dependent on cable type, see table below:

Cable	1k2 baud	4k8 baud	9k6 baud	19k2 baud	No. of Wires
Belden 9182	1000 m	1000 m	1000 m	700 m	2
Belden 9207	1000 m	1000 m	1000 m	500 m	2
Trend TP/1/1/22/HF/500 (Belden 8761)	1000 m	1000 m	700 m	350 m	2
Trend TP/2/2/22/HF/500 (Belden 8723)	1000 m	1000 m	500 m	250 m	4

Network baud rate : Set by keypad 1k2, 4k8, 9k6, or 19k2 set to be same as other nodes on Lan.
Network address : Set by keypad, 116 nodes addressable (4 to 119 excluding 10, 11) set to be unique on Lan.

Indicators
Lan OK : (green) ON if network is operating. Flashes if invalid address set on address switches.
pCO Error : (red) ON if connection between IQPCO and pCO is in error

Mechanical
Dimensions : 60 mm x 30 mm x 12 mm
Network connector : 1 off 2 part connector with 4 screw terminals for 0.5 to 2.5 mm^2 cross section area cable.

Environmental
Storage Temperature : -20 °C to +80 °C
Operating temperature : -10 °C to +60 °C
Humidity : 20 to 80 %RH
Protection : IP00
Classification according to protection against electric shock: to be incorporated into Class I or II equipment
Category of heat and fire resistance: D

Version This document applies to the following version:
Firmware : v1

PCO Tool

The specifications below are those recommended to run PCO Tool. They refer to a standard PC with mouse, keyboard, hard drive, CDROM drive, monitor and sound capabilities (optional).

Hardware
Processor : 200 mHz Intel Pentium
RAM : 64 Mb RAM
Hard disk : 1 Gbyte
Graphic card : 2 Mbyte RAM capable of 1024 x 768 (256 colours)
Serial Port : 1 (if connected via LNC2 or CNC2)
PCI slot : 1 (if connected via LNC2)
Operating system : Microsoft NT4 with service Pack 5 or Windows 2000

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