Cybro Hardware Manual

version 3.25

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This manual describes electrical and mechanical aspects of Cybro controller, IEX-2 modules and accessories. For material about software and programming, check CyPro User Manual.

Safety

Warning		death, severe injury or substantial property damage may result if proper precautions are not taken
Caution		medium injury or property damage may result if proper precautions are not taken
Caution		hazard of severe electric shock, injury or property damage may result if proper precautions are not taken

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REGULATIONS

This product can function correctly only when operated, maintained, transported, stored, installed and configured in accordance with all recomendations. Failure to comply with applicable standards may result in damage to equipment or serious injury to personnel.

To minimize safety problems, follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary geographically and may change with time. It is your responsibility to determine which codes should be followed and to verify that the equipment, installation, and operation comply with the latest revision of these codes.

EMERGENCY STOP

Control devices may fail in an unsafe condition, resulting in unexpected operation of managed equipment. Such unexpected action could result in death or serious personal injury, and/or equipment damage. Always install emergency stop switch, electromechanical override, and other redundant safeguards independent of the controller.

POWER SUPPLY

Always connect power supply that meets the voltage rating shown on the front panel. A Cybro controller may fail in an unsafe manner or present an electrical shock hazard to personnel if 230V AC is applied to terminals intended for 24V. Such failure could result in death, severe personal injury and/or equipment damage. Use 24V source that provides safe electrical separation from 230V AC. Never touch the terminals while the power is on.

CIRCUIT BREAKER

Provide a circuit breaker rated 6A/Type B that removes power from Cybro and the connected expansions. Circuit breaker or separate disconnect switch should be physically near the controller.

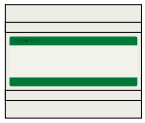
SEPARATE SIGNALS

Separate high-energy AC and DC wiring from low-energy signal wiring. Equip inductive loads with suppression circuit. Use 0.5-1.5 mm (22-14 AWG) wires. Use 85°C rated wires or higher, if there are external heat sources nearby. Put ferrules and sleeves on wires before connecting to terminals. All wirings should be performed by qualified personnel.

Products

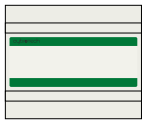
Product range

Industrial



simple I/O
opto-coupler inputs
configuration in controller
addressed by serial number
can't work without controller

Building



simple I/O
dry contact inputs
configuration in controller
addressed by serial number
can't work without controller

Residential

local functionality
dry contact inputs
configuration in local EE
autoaddressing by position
limited stand-alone operation

Download

http://www.cybrotech.com

Cybro-2 only

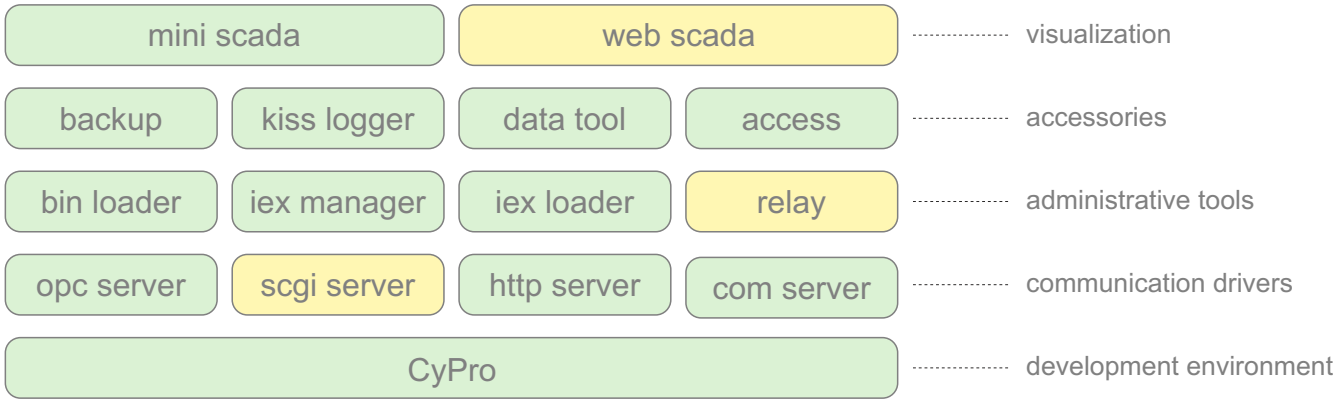
Cybro-3 only

Cybro-2 and Cybro-3

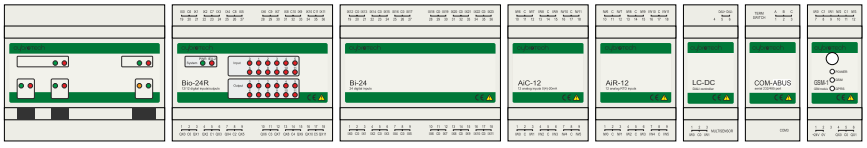
internet

local network

Software



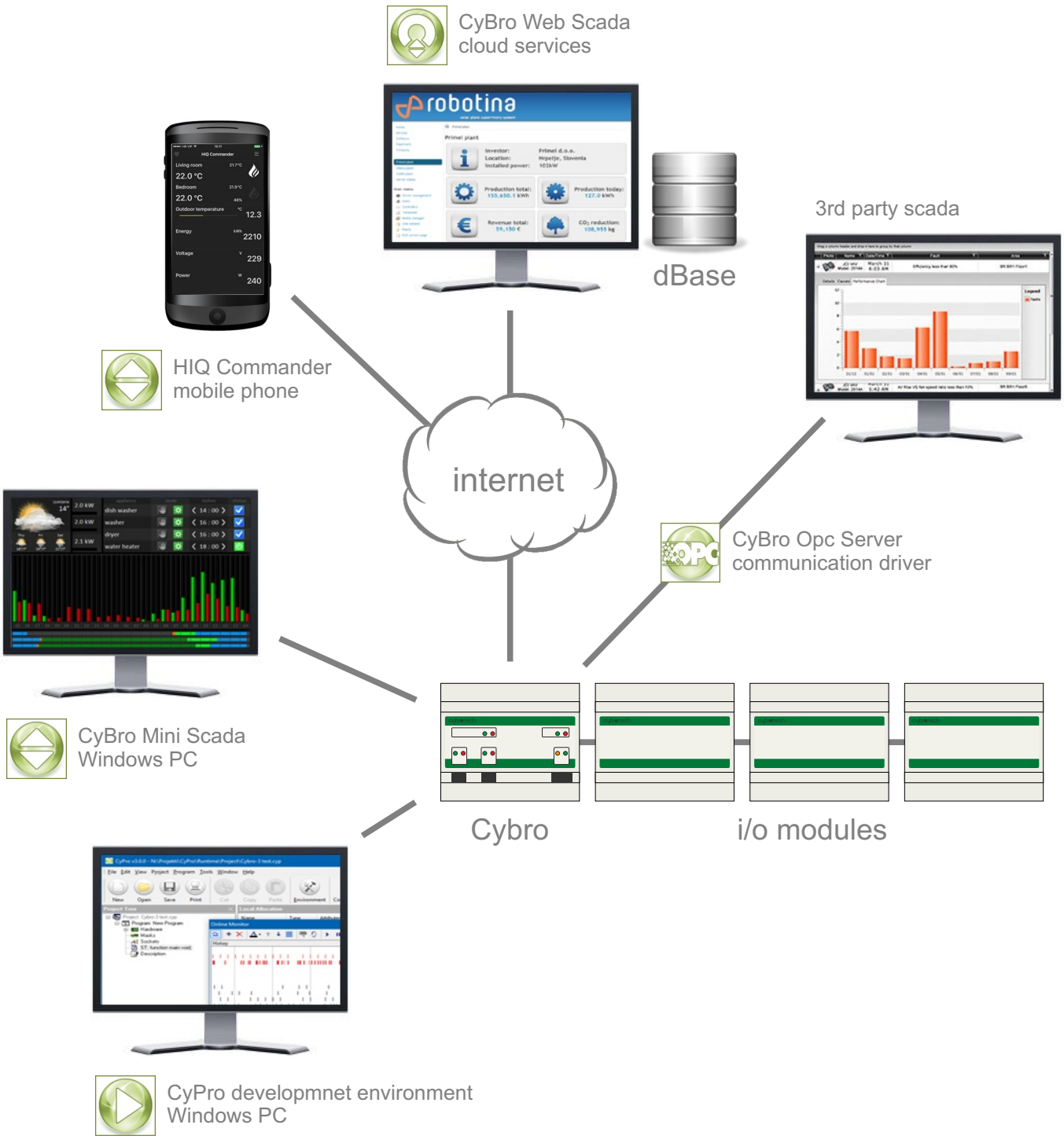
Hardware



switchboard

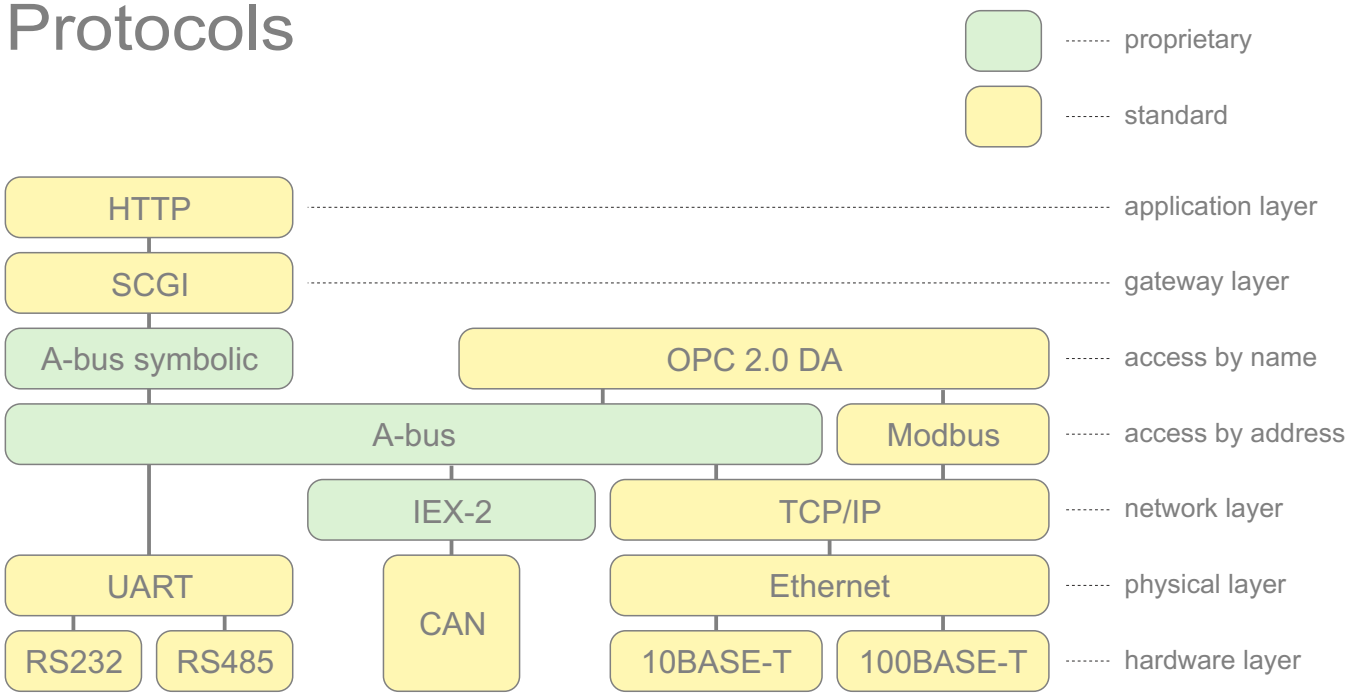
field modules

System



Cybro system consists of controller, i/o modules, and software tools for programming, monitoring and visualization. Internet connectivity is integral part od the system.

Protocols

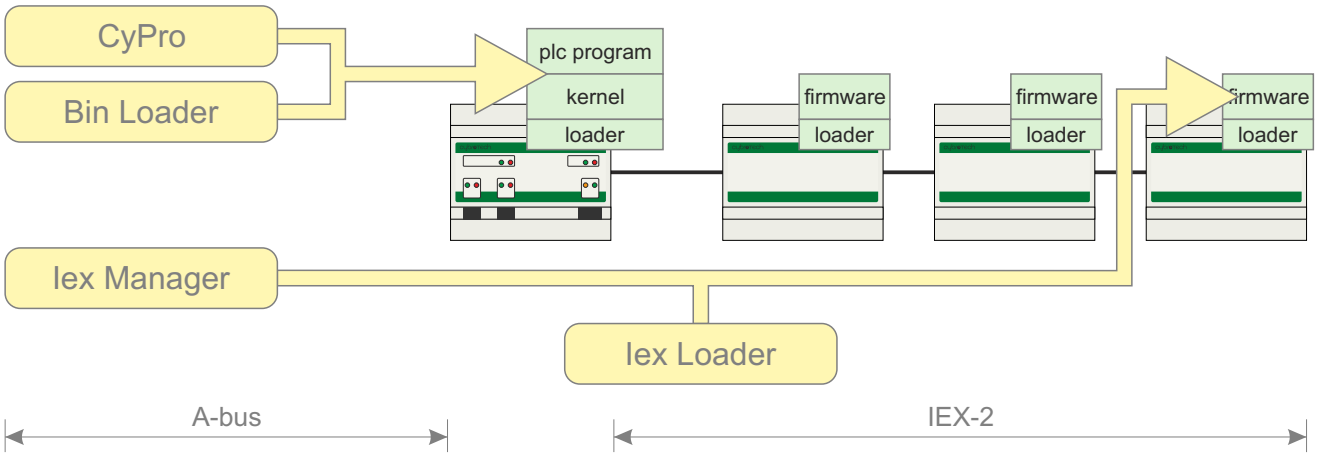


Cybro controller use standard protocols whenever possible. Proprietary protocols are developed when to achieve extra functionality and keep hardware requirements low.

Comparing to Modbus, A-bus offers IP autodetection, NAT traversal (automatic connection to internet), CAN tunneling and symbolic extensions (access by name).

Comparing to CANopen and DeviceNet, IEX-2 serve basically the same function, but the software footprint is as low as 2kb, which makes it possible to use a tiny bootloader.

Firmware update



Cybro firmware (kernel) is updated with CyPro or CyBroBinLoader. To use the loader, program must be saved in binary form.

IEX-2 modules are updated with CyBroIexManager. Communication is going through controller, no additional hardware is needed. CyBroIexLoader is doing essentially the same task, but it is optimized for developers, and the aditional CAN adapter is needed.

Firmware upgrade is safe, device will never brick, whatever may happen during the process. To activate device that appear unresponsive, contact tech support.

Mounting

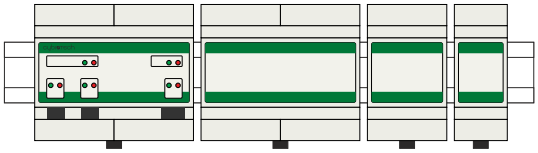
Cybro controller and expansions should be mounted vertically onto the standard DIN rail (DIN EN 50022), within a suitable enclosure. Total power dissipation inside the enclosure must not exceed permissible enclosure dissipation. Cybro is designed for a natural convection cooling, you must provide a clearance of at least 30 mm above and below the unit.

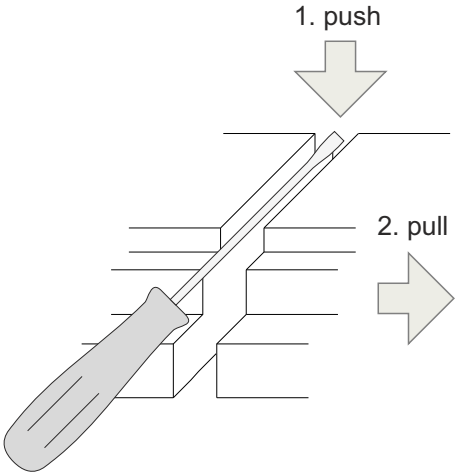
Caution

When product is subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or hard impacts, it may result in an electric shock, fire or malfunction.

Install this product according to instructions. If installation is not performed correctly, it may result in unit malfunction or failure. Do not allow foreign objects, such as wire scraps, to enter the unit. This may cause fire, unit failure or malfunction.

Open the DIN clip to allow mounting, and snap close to secure the unit on the rail. When connecting units with zero-length cable, snap it first to the left unit, then snap the right unit onto the cable.





To disconnect units, use a small screwdriver to push connector clip, then pull the unit away.

IEX-2 bus

General

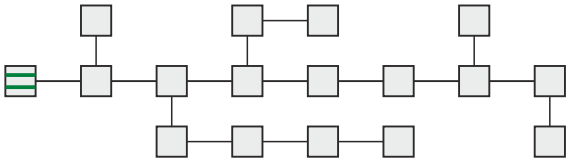
IEX-2 bus connects peripheral devices to main controller. It is based on CAN 2.0B extended frame protocol. Four wires are used, +24V/GND for power supply and CANL/CANH for communication. CAN is deterministic bus with short prioritized messages, response time is in milliseconds.

Each module has unique 21-bit network address (NAD). Module can also have alias address, assigned with IEX Manager. When alias is set, original address can't be used.

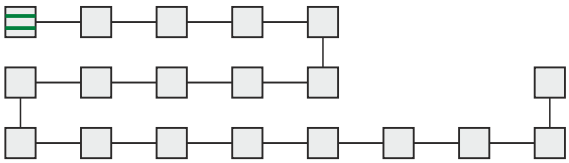
Residential modules (HIQ) are subset of IEX modules. They fully comply to the specification, and also have some additional features: internal functionality, internally stored parameters and autoaddressing.

Network topology

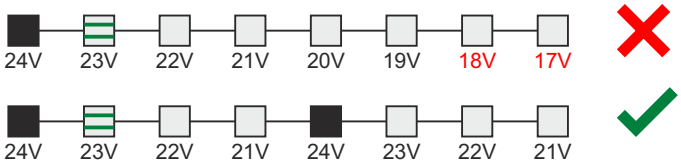
MESH



LINE



Secondary power supply



Bus length

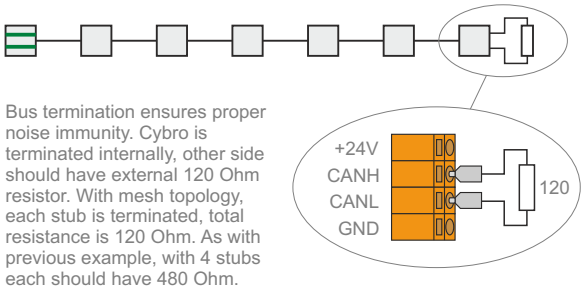
There are two factors which affect the maximum cable length:

1. Voltage drop
Wire resistance causes a drop in supply voltage. It depends on length, wire gauge and power consumption. Gauge must be selected to ensure the last module has at least a minimum allowed voltage. Otherwise, additional power supply must be inserted between the modules.

2. Signal delay
Communication speed is limited with propagation time and topology. With the default 100kbps, up to 100m can be used without restrictions. Longer cable must be connected as a line and properly terminated.

Baudrate	MESH	LINE
20kbps	500m	1000m
50kbps	200m	500m
100kbps (default)	100m	300m
250kbps	50m	100m
500kbps	20m	50m

Termination



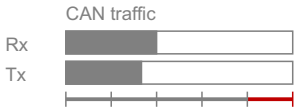
Bus termination ensures proper noise immunity. Cybro is terminated internally, other side should have external 120 Ohm resistor. With mesh topology, each stub is terminated, total resistance is 120 Ohm. As with previous example, with 4 stubs each should have 480 Ohm.

Status LED

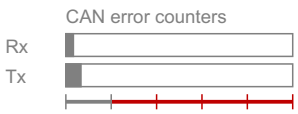
PWR	Status	Action
on	power supply ok	-
blinking	internal error	replace module
off	no power supply	check power supply
IEX		
on	no communication	check wiring
blinking	communication ok	-
off	no communication	check wiring

Each IEX-2 module has PWR and IEX LEDs, visible when cover is lifted.

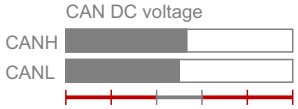
Diagnostic variables



Number of transmitted and received messages per second. Overload may cause a slower response time.



Current state of CAN error counters. High number may be caused by harsh environment or bad wiring.



DC voltage measured on bus lines. More then 10% difference between lines indicate a hardware fault.

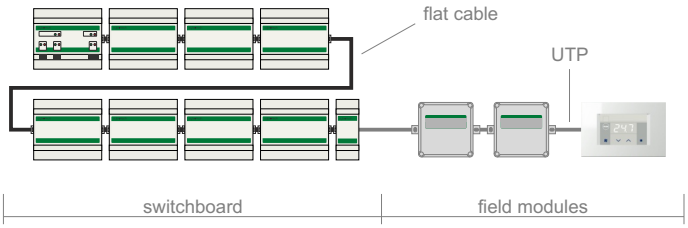
A set of indicators related to bus health. Irregular values are caused by chip defect or short circuit. Slightly off range value may serve as an early warning, before the major malfunction occur. To find the faulty device, disconnect them from the bus one by one.

Technical specifications

Power supply	24V (18..28V)
Baud rate	20, 50, 100 (default), 250, 500kbps
Baud configuration	PLC: set manually in kernel settings IEX: auto selectable on power on
Termination resistor	120 Ohm 0.25W
Recommended cable	unshielded twisted pair 2x2 0.5mm2

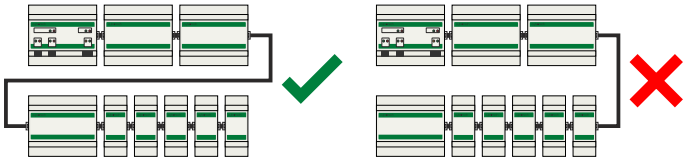
Wiring

Switch panel and field modules

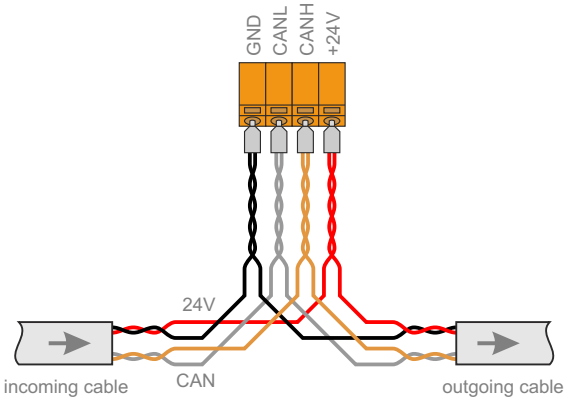


Inside the switchboard bus is connected using flat cable assembly with modular RJ9 connectors. Outside the switchboard bus is connected using unshielded twisted-pair cable, inserted into orange push-wire terminals.

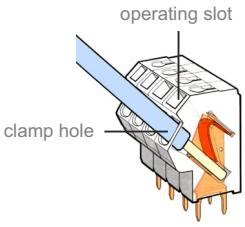
Switch panel wiring



Field connection



Push-wire handling



Solid wire insertion

1. Push wire in the clamp hole

Stranded wire insertion

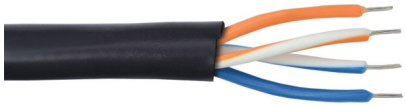
1. Push screwdriver in the operating slot
2. Insert wire in the clamp hole

Solid/stranded wire removal

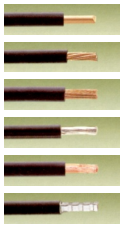
1. Push screwdriver in the operating slot
2. Remove wire

Recommended bus cable

unshielded twisted pair 2x2 0.5mm2



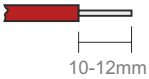
Wire type



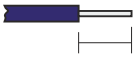
solid
stranded
fine-stranded
fine-stranded, tined
fine stranded, tip bonded
stranded with ferrule (recomended)

Wire strip

Bus wires (orange terminals)

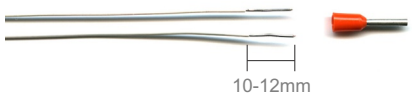


Other wires (gray terminals)



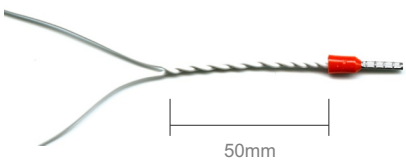
Ferrule

1. Take one ingoing and one outgoing wire together, and remove insulation for about 10-12mm.



2. Crimp wires together into a ferrule.

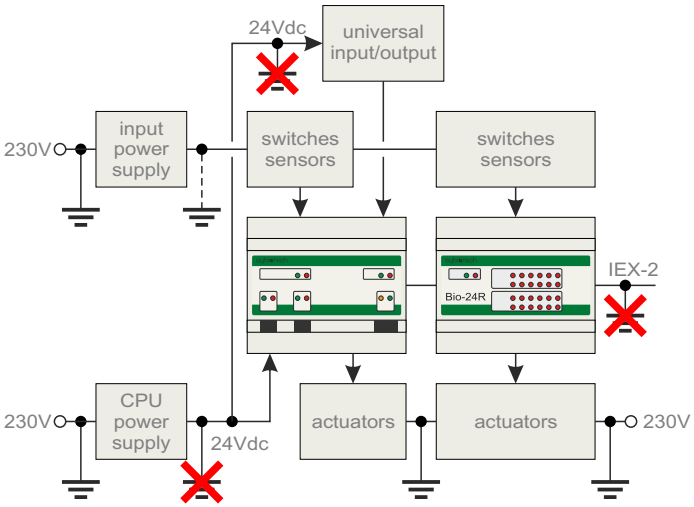
3. Wrap wires together for a few centimeters.



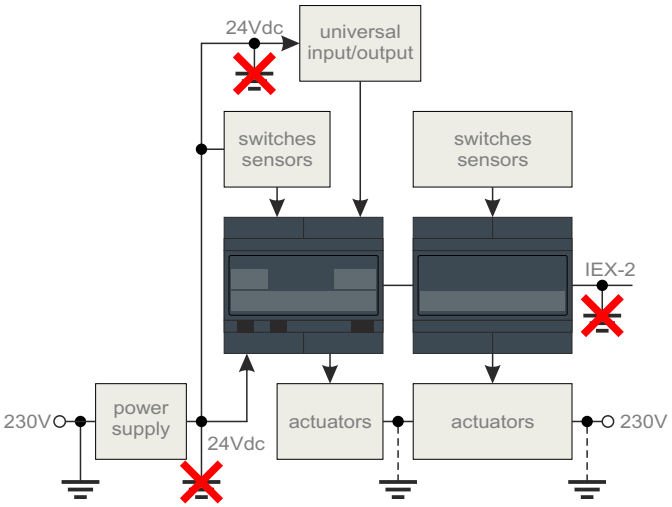
4. Push ferrules into clamps.

Supply and grounding

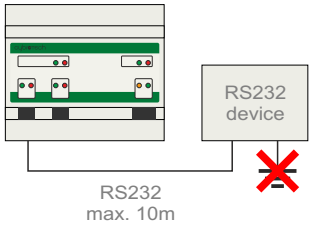
Industrial environment



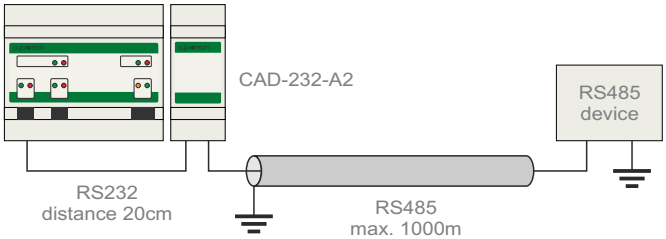
Home and building environment



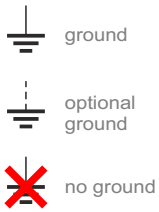
RS232 connection



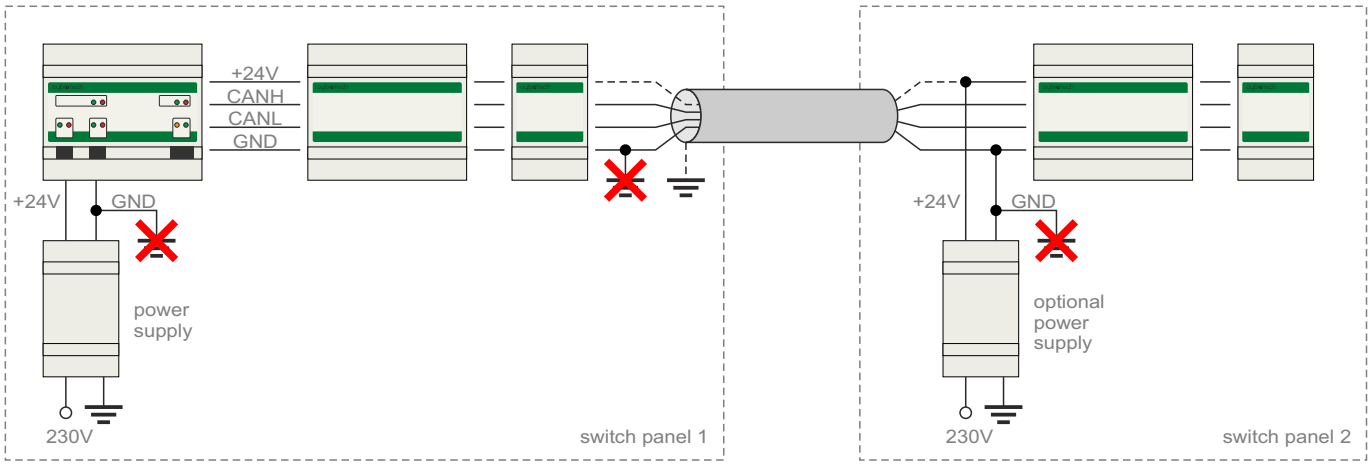
RS485 connection



Legend

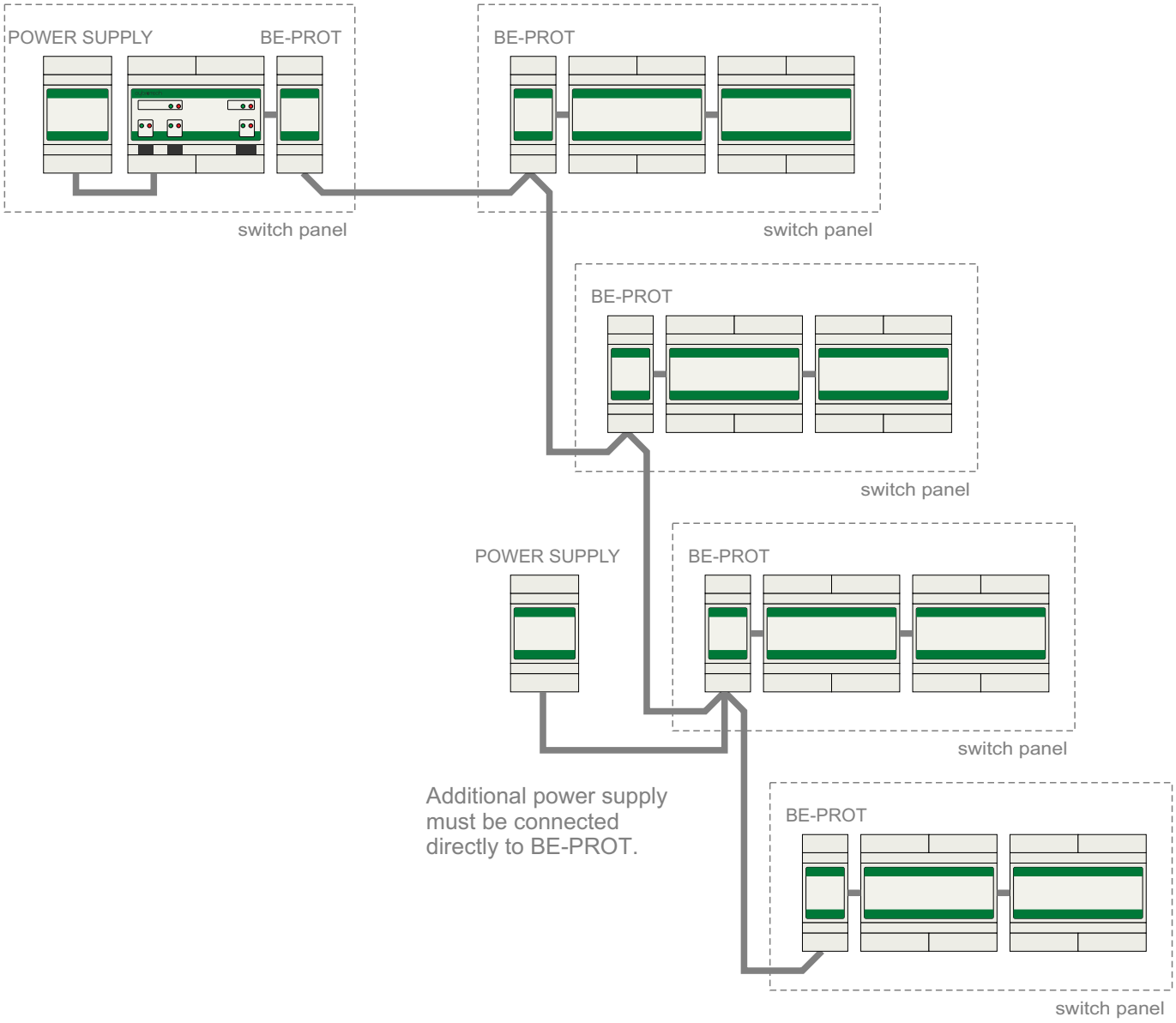


Connecting switch panels



+24V line may be cut off, depending on type of power supplies. If they can work in parallel, leave it connected. GND line (digital ground) must be connected to all devices, failure to do so may result in severe damage. GND is never grounded, cable shield may be grounded or not. Generally, it is grounded in industrial, and left floating in home and building applications.

Switch panels



The recommended wiring for multiple switch panels. Bus protection device (BE-PROT) shields panel against power surges. Standard recommendations for cable type, length and termination apply.

Internet

This chapter covers connecting Cybro over the internet. To do this, two problems has to be solved: how to create public address, and how to get through the router. Both problems can be solved with Cybrotech software and commonly available tools and services.

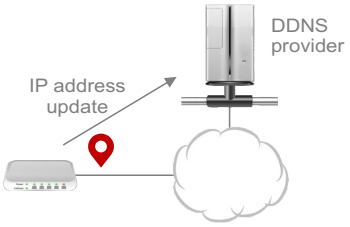
Public address

Static IP

Service available from your internet service provider. Depending on location, it may be difficult or impossible to get.

Dynamic DNS

Service offered by specialized providers (dyndns.org, no-ip.com, easydns.com...). Must be supported by your router.



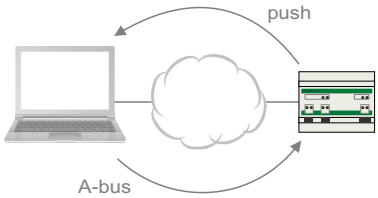
Get through the router

Port forward

Router is configured manually to forward incoming message to the device. Router must have the known public address.

Push message

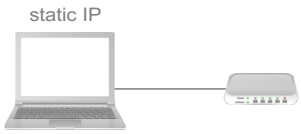
Router is configured automatically. Controller sends message that create NAT record, to keep the connection alive.



Local static address

Port forward needs an IP address that does not change. That can be done in two ways:
- static IP set on device
- DHCP IP reservation on router

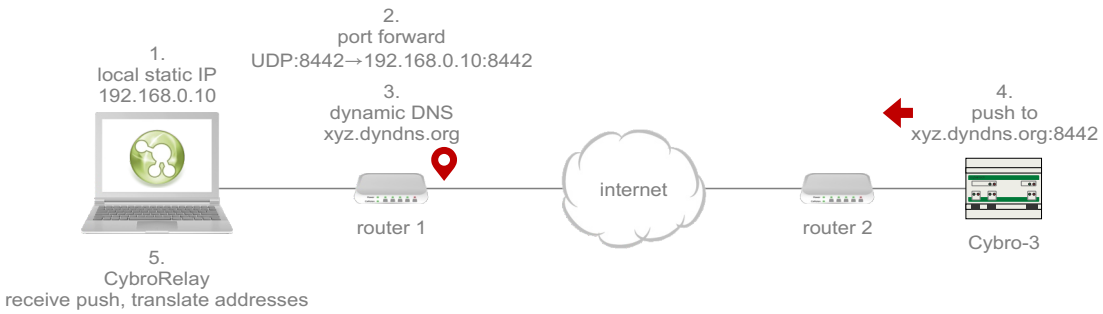
The second option is preferable.



Example

1. assign local static IP address
2. configure port forward
3. subscribe to dynamic DNS
4. configure controller to send push
5. start CybroRelay

When relay is running, all programs access controller as if it is in the local network



Push message

cybro → xyz.dyndns.org:8442
router 2 creates temporary NAT record
router 2 → xyz.dyndns.org:8442
router 1 → PC port 8442 (CybroRelay)
relay creates temporary translation table

A-bus request

CyPro → relay → router 1 → router 2 → Cybro

A-bus response

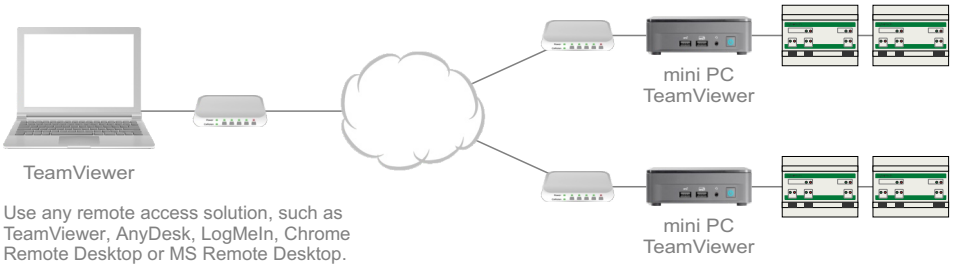
Cybro → router 2 → router 1 → relay → CyPro

Solutions

visualization: SCADA+CybroOpcServer, CybroWebScada, CybroMiniScada, HIQ Office
data logger: SCADA+CybroOpcServer, CybroWebScada, CybroKissLogger, CybroBackup
program update: CyPro, CybroBinLoader

Remote desktop

difficulty: 1 (easy)

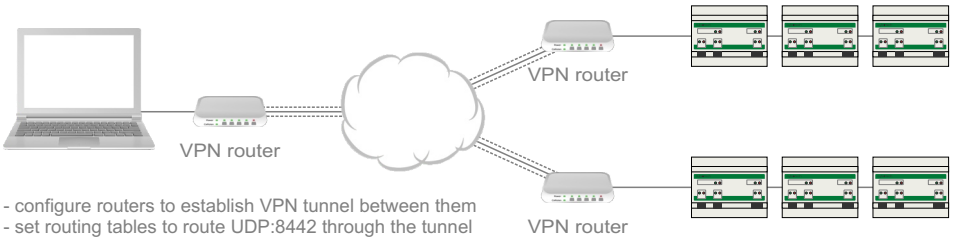


Use any remote access solution, such as TeamViewer, AnyDesk, LogMeIn, Chrome Remote Desktop or MS Remote Desktop.

Remote desktop is service that allows you to access computer from a remote location. With remote desktop, you can view computer's desktop, run applications, access files, and perform tasks as if you are physically in front of the computer.

Site-to-site VPN

difficulty: 2 (simple)



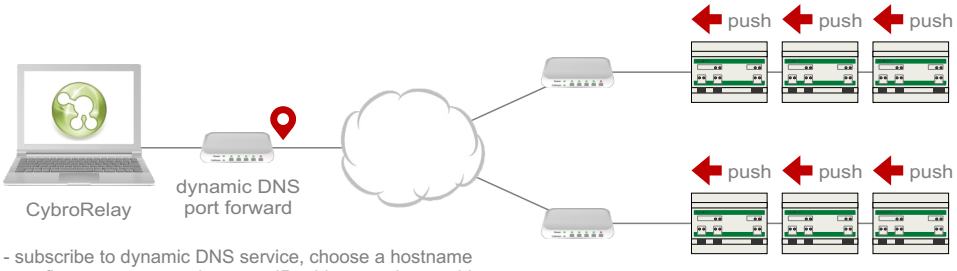
- configure routers to establish VPN tunnel between them
- set routing tables to route UDP:8442 through the tunnel

When VPN is configured to route subnet broadcasts, all programs can be used same as in the local network. This solution also enables cybro-to-cybro communication, based on sockets.

When broadcast is not routed, IP address for each controller must be manually configured. Cybro-to-cybro communication can not be realized.

Cybro relay

difficulty: 3 (moderate)



- subscribe to dynamic DNS service, choose a hostname
- configure router to update your IP address at the provider
- configure controllers to push to the hostname, port 8442
- assign static IP address to your PC
- forward router UDP port 8442 to your PC, port 8442
- open CybroRelay on your PC

When relay is active, all Cybro programs can be used as if they are in the local network.

The system is known as UDP hole punching. Push message (also called 'keep-alive') is transversed backward, so that used program can use the channel to send commands forward.

Simple redirect

difficulty: 3 (moderate)

- subscribe to dynamic DNS service, choose a hostname
- configure router to update your IP address at the provider
- assign static ip address to all controllers
- create one port forward for each controller
- configure your program, for each controller enter hostname and port

UDP:50000 → 192.168.0.100:8442
UDP:50001 → 192.168.0.101:8442
UDP:50002 → 192.168.0.102:8442

The only two programs which can be used in this configuration are CyPro and CybroOpcServer. IP address and port number must be entered for each controller separately. Any port above the registered range may be used.

Mobile app

difficulty: 1 (easy)

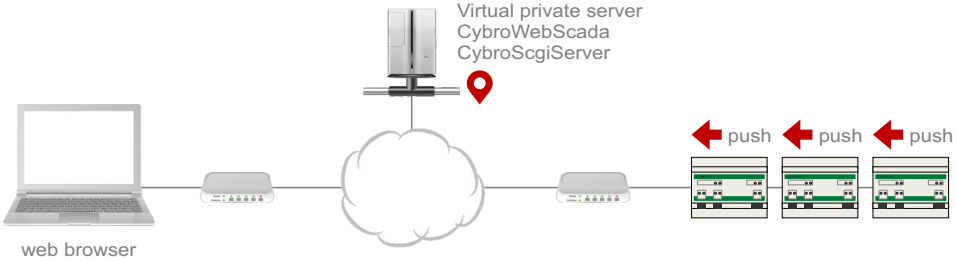
- mark your variable as "visible on smartphone"
- add tags to customize appearance and behavior
- configure controller to push to my.hiq-home.com
- install HIQ Commander and autodetect configuration

During the autodetect phase, phone must be in the same local network as the controller. That is a security measure that ensures ownership of the controller.

HIQ is a service that Cybrotech offers for its devices. It provides public address and data read/write. For more details, open CyPro User Manual, Features, Mobile application.

Web scada

difficulty: 5 (expert)



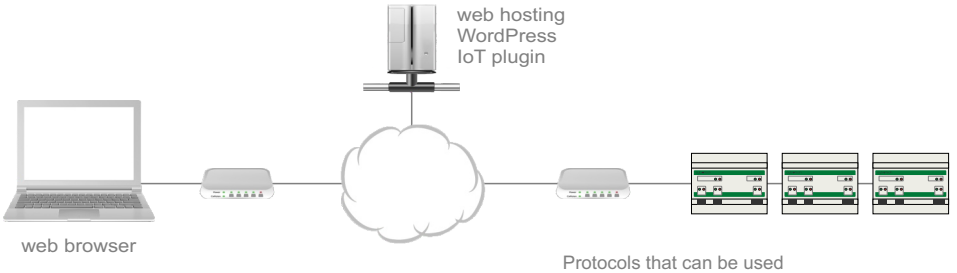
- subscribe to VPS service (virtual private server)
- install CybroWebScada and CybroScgiServer
- create web pages and configure data logger
- configure controllers to push to hosted service

This solution requires knowledge of Python programming and network administration.

CybroWebScada is open-source project, written in Python/Django. User creates pages in plain HTML. Dynamic objects include bitlist, bargraph, edit box and timeplot. Communication with controller relies on CybroScgiServer. As example, check http://www.solar-cybro.com.

WordPress

difficulty: 4 (advanced)



- subscribe to web hosting service
- install WordPress, select IoT/SCADA plugin
- select communication protocol and connect controller

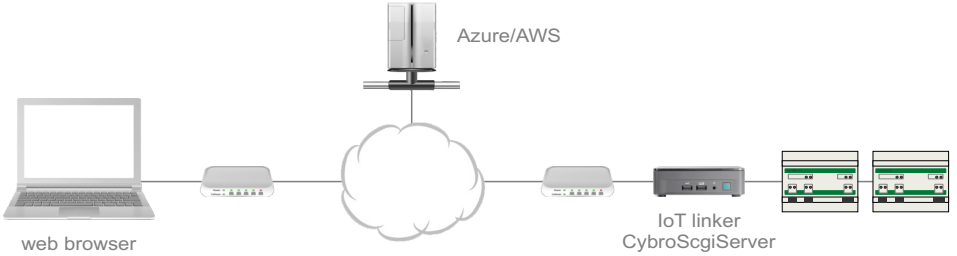
Protocols that can be used
- Modbus TCP (supported by firmware)
- HTTP/XML (supported as plc example)
- MQTT (can be implemented as plc program)

WordPress can be a base of IoT solution by using plugins. Plugins provide user-friendly interface for configuring connection, retrieving data and displaying on the site. You can create dashboards, charts, and reports to monitor and analyze your industrial process or other applications.

This allows you to take advantage of flexibility and ease of use, without the specialized software or hardware. WordPress is highly customizable and extensible, so you can tailor solution to specific needs and requirements.

Cloud platform

difficulty: 4 (advanced)



- subscribe to Azure platform
- install Azure IoT hub as communication gateway
- install Azure Power BI for data visualization
- install Azure Blob Storage or SQL for history data

IoT linker is based on SBC or mini PC, running open protocols such as MQTT ot AMQP. Communication to controller is realized with CybroScgiServer for web based solutions, or CybroOpcServer for SCADA based solutions.

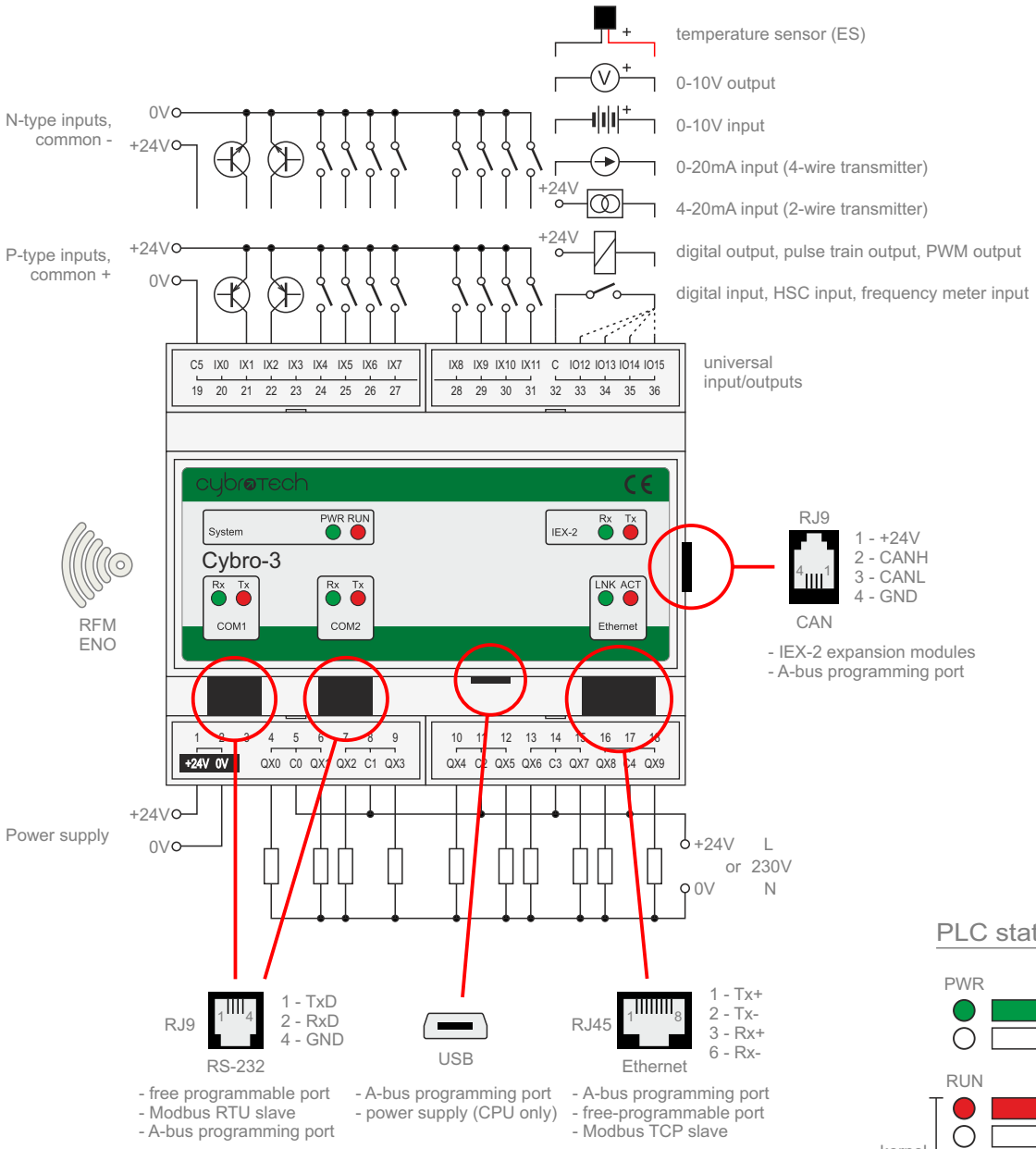
Cloud computing is powerfull, flexible solution which offers access, management, and development of applications and services through global data centers. A number of programming languages, tools, and frameworks enables quick production of complex solutions. This is a platform of choice for business solutions.

Cybro-3

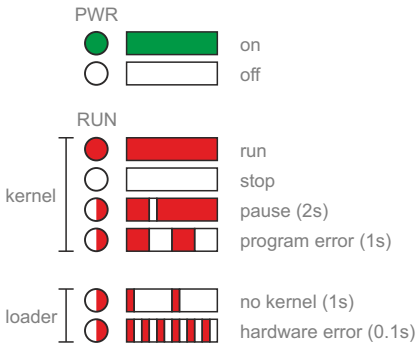
programmable controller
12 opto-coupler inputs 24V
10 relay outputs 8A
4 universal input/outputs
Ethernet, USB, IEX-2, 2x RS-232
RFM free-programmable radio
EnOcean gateway
24V DC power supply

industrial building

EXAMPLE
CyPro/Examples/
CybroDashboard



PLC status

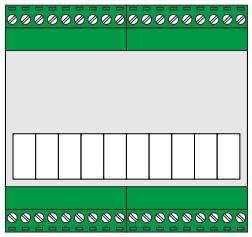


For more details, check CyPro status bar.

Order code

Base model

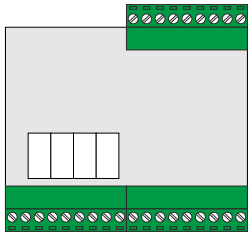
- ◉ Cybro-3-24



12 opto-coupler inputs
10 relay outputs 8A
4 universal inputs/outputs
24V DC power supply

industrial building

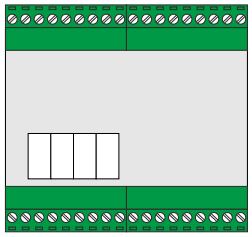
- ○ Cybro-3H-230



3 digital inputs
4 relay outputs 8A
4 universal inputs/outputs
1 RS485 interface (COM3)
230V AC power supply

building

- ○ Cybro-3W-230



8 digital inputs
4 relay outputs 8A
4 NPN outputs 1A
2 Wiegand interface
1 RS485 interface (COM3)
230V AC power supply

building

Options

- ◉ no wireless
- ○ RFM, free-programmable wireless
- ○ ENO, EnOcean wireless gateway

- ☐ ISO, galvanically isolated RS485

Note:

- ISO applies to models with RS485 interface
- RFM is used for wireless modbus (WM-1, WR-1, WR-5), DALI lights (WD-1), and cybro-to-cybro communication
- when ENO is used, RS485 is connected to COM1 (parallel to the RS232), instead of COM3
- RFM and ENO options can not be selected at the same time

Examples:

Cybro-3-24	base model, 24V DC power supply
Cybro-3H-230	3H model with RS485 interface, 230V AC power supply
Cybro-3H-230-RFM-ISO	3H model with galvanically isolated RS485, wireless interface, 230V AC power supply

Terminals

Cybro-3-24

No	Name	Description
1	+24V	power supply input
2	0V	digital ground, power supply input
3	-	not connected
4	QX0	relay output qx00
5	C0	common for qx00 and qx01
6	QX1	relay output qx01
7	QX2	relay output qx02
8	C1	common for qx02 and qx03
9	QX3	relay output qx03
10	QX4	relay output qx04
11	C2	common for qx04 and qx05
12	QX5	relay output qx05
13	QX6	relay output qx06
14	C3	common for qx06 and qx07
15	QX7	relay output qx07
16	QX8	relay output qx08
17	C4	common for qx08 and qx09
18	QX9	relay output qx09

No	Name	Description
19	C5	common for ix00..ix11
20	IX0	digital input ix00
21	IX1	digital input ix01
22	IX2	digital input ix02
23	IX3	digital input ix03
24	IX4	digital input ix04
25	IX5	digital input ix05
26	IX6	digital input ix06
27	IX7	digital input ix07
28	IX8	digital input ix08
29	IX9	digital input ix09
30	IX10	digital input ix10
31	IX11	digital input ix11
32	C	digital ground, common for io12..io15
33	IO12	universal input/output io12
34	IO13	universal input/output io13
35	IO14	universal input/output io14
36	IO15	universal input/output io15

Cybro-3H-230

No	Name	Description
1	230V L	power supply input, live
2	230V N	power supply input, neutral
3	-	not connected
4	QX0	relay output qx00
5	C0	common for qx00 and qx01
6	QX1	relay output qx01
7	QX2	relay output qx02
8	C1	common for qx02 and qx03
9	QX3	relay output qx03
10	-	not connected
11	-	not connected
12	A	RS485 communication line +
13	B	RS485 communication line -
14	C	RS485 protective ground
15	GND	digital ground for IEX modules
16	CANL	communication line for IEX modules
17	CANH	communication line for IEX modules
18	+24V	power supply output for IEX modules

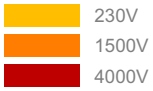
No	Name	Description
28	IX0	digital input ix00
29	IX1	digital input ix01
30	IX2	digital input ix02
31	+24V	power supply output for universal i/o
32	GND	digital ground, common for io12..io15
33	IO12	universal input/output io12
34	IO13	universal input/output io13
35	IO14	universal input/output io14
36	IO15	universal input/output io15

Cybro-3W-230

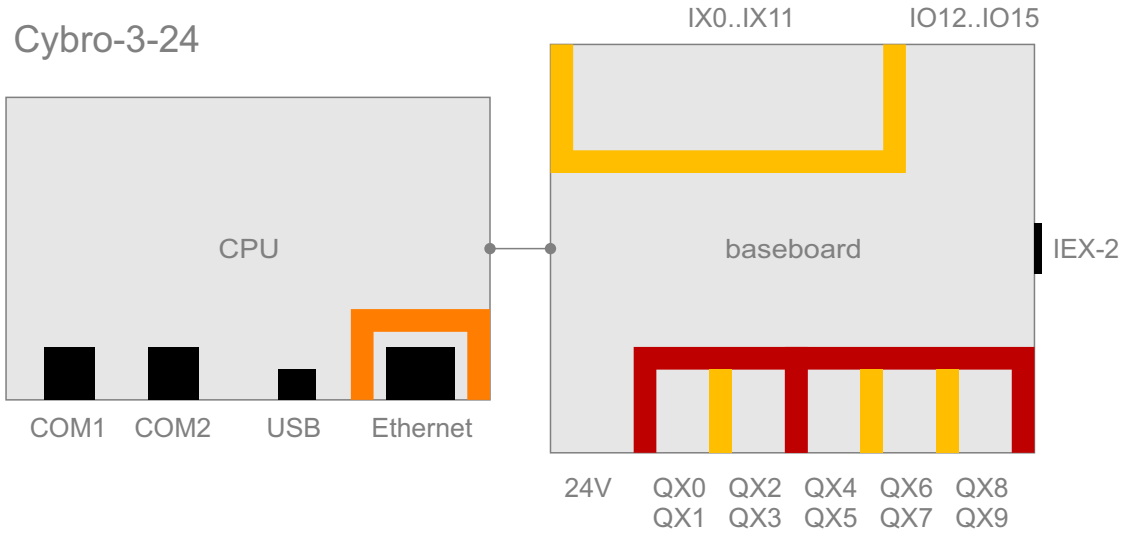
No	Name	Description
1	230V L	power supply input, live
2	230V N	power supply input, neutral
3	-	not connected
4	QX0	relay output qx00
5	C0	common for qx00 and qx01
6	QX1	relay output qx01
7	QX2	relay output qx02
8	C1	common for qx02 and qx03
9	QX3	relay output qx03
10	-	not connected
11	-	not connected
12	A	RS485 communication line +
13	B	RS485 communication line -
14	C	RS485 protective ground
15	GND	digital ground for IEX modules
16	CANL	communication line for IEX modules
17	CANH	communication line for IEX modules
18	+24V	power supply output for IEX modules

No	Name	Description
19	C2	digital ground, common for ix00..ix07
20	IX0	digital input ix00
21	IX1	digital input ix01
22	IX2	digital input ix02
23	IX3	digital input ix03
24	IX4	digital input ix04
25	IX5	digital input ix05
26	IX6	digital input ix06
27	IX7	digital input ix07
28	+12V	power supply output for wiegand readers
29	GND	digital ground for wiegand readers
30	D0	wiegand D0 line, common for both readers
31	D1-0	wiegand D1 line, first reader
32	D1-1	wiegand D1 line, second reader
33	QX12	transistor output qx12
34	QX13	transistor output qx13
35	QX14	transistor output qx14
36	QX15	transistor output qx15

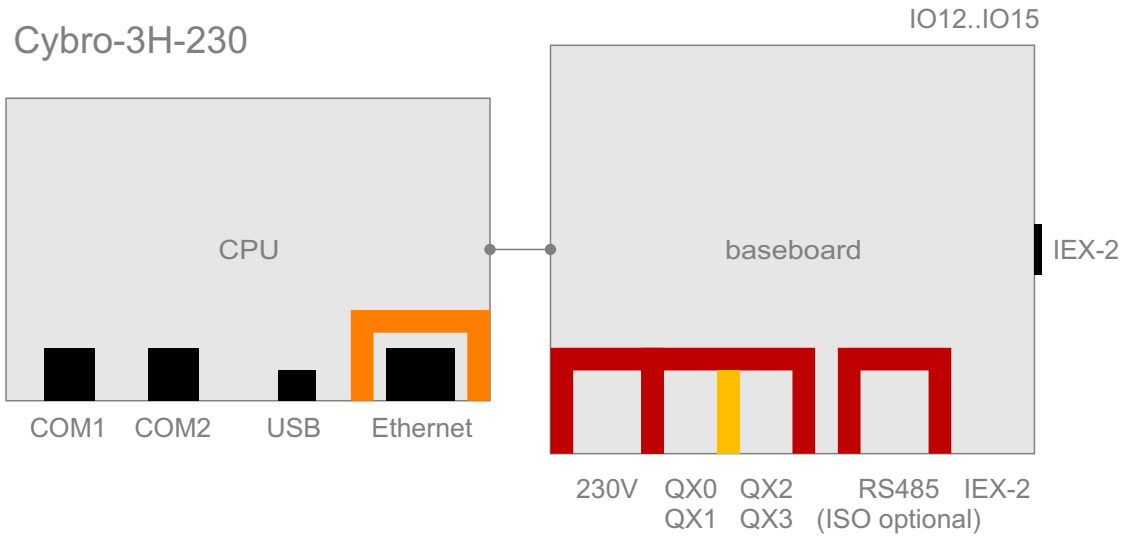
Galvanic isolation



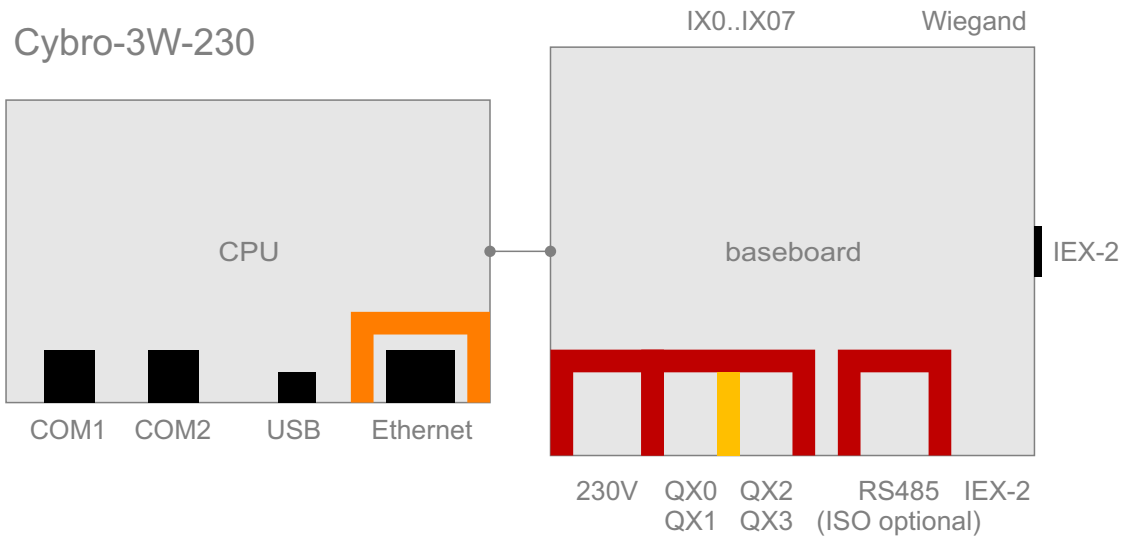
Cybro-3-24



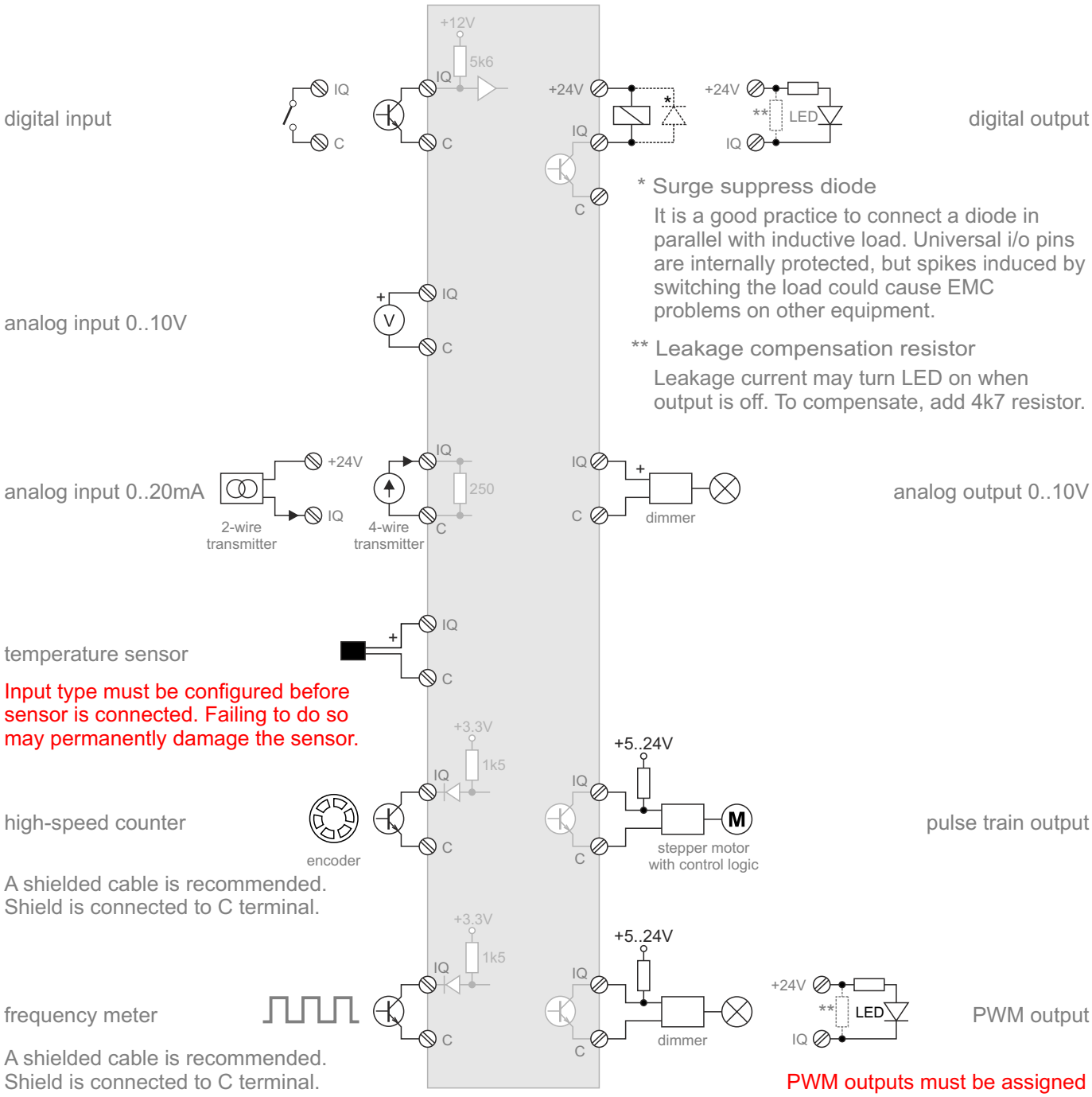
Cybro-3H-230



Cybro-3W-230



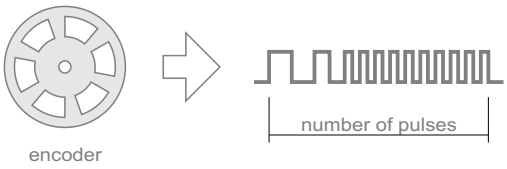
Universal input/output



Mode	ix	qx	iw	qw
0. not used	-	-	-	-
1. binary input	binary input	-	mV	-
2. binary output	binary input	binary output	mV	-
3. analog input 0..20mA	-	-	uA	-
4. analog input 0..10V	-	-	mV	-
5. analog output 0..10V	-	-	mV	0..10000mV
6. temperature sensor	-	-	0.1°C	-
7. single phase counter	binary input	reset	pulse count	-
8. dual phase counter	binary input	reset	pulse count	-
9. frequency meter	binary input	-	Hz	-
10. pulse train output	run indicator	start	pulse count	0..65535 pulses
11. pwm output	-	-	-	0..100%

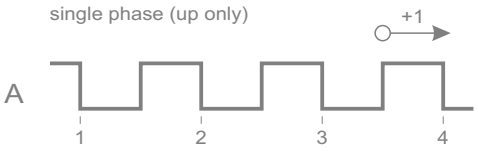
Input/output variables, related to the selected mode. Output monitoring is avaliable in most modes.

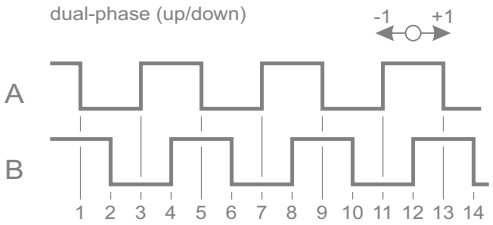
High-speed counter

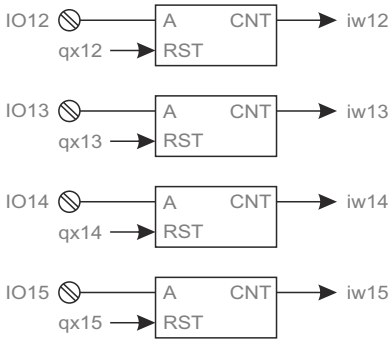


Extend counting range from 16 to 32-bit:

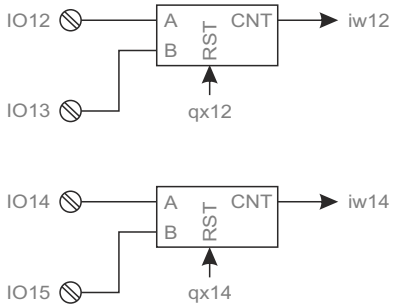
```
long iw12_long, int iw12_old;

iw12_long := iw12_long + (iw12 - iw12_old);
iw12_old := iw12;
```







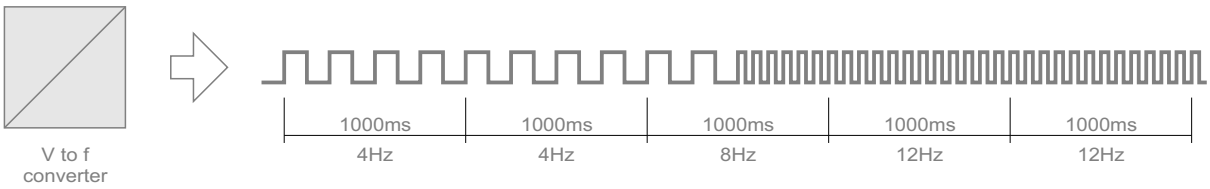
A - counter input
CNT - number of pulses
RST - reset

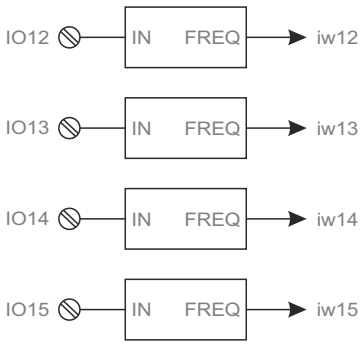


A, B - counter inputs
CNT - number of pulses
RST - reset

Counter value may lag up to 5ms to Cybro core. Also, reset command from core to counter may lag another 5ms.

Frequency meter

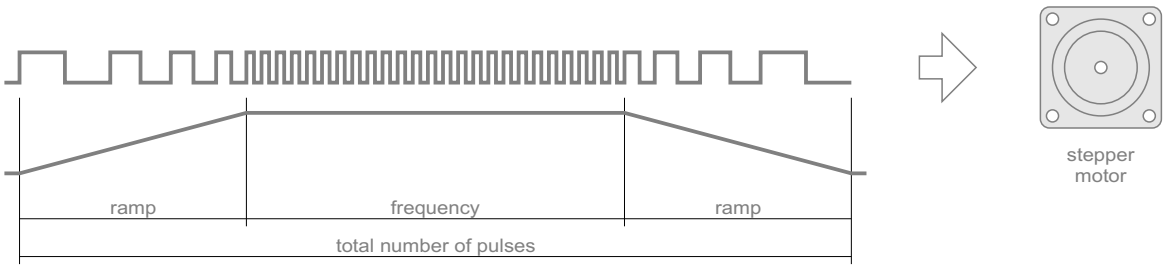


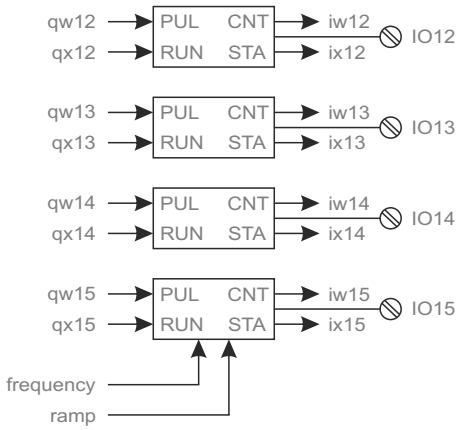


IN - counter input
FREQ - measured frequency [Hz]

Pulses are counted inside the time frame of 1000ms.

Pulse train output

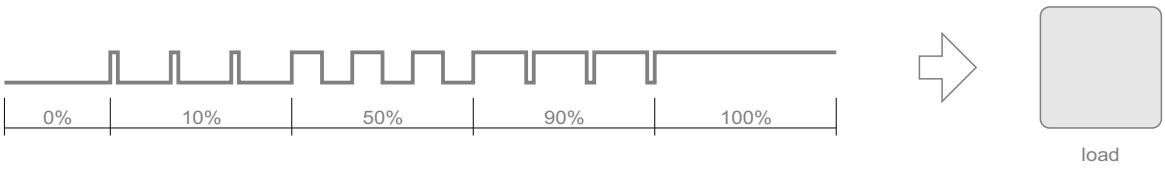


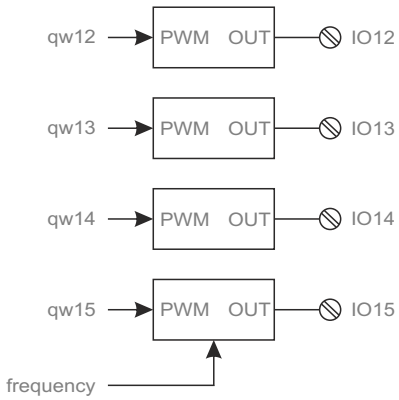


PUL - number of pulses requested
RUN - start signal (1-run)
CNT - number of pulses counted
STA - status (0-stop, 1-running)

Frequency and ramp are sampled when pulse train is started. After the run request is cleared, changes does not affect the output. That given, each channel can run on it's own frequency.

PWM output

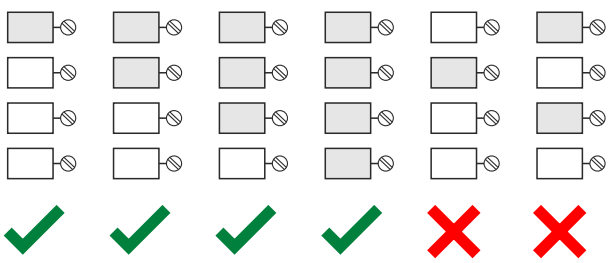




PWM - pulse width 0..100%
OUT - output terminal

A single frequency setting is common for all outputs [Hz].

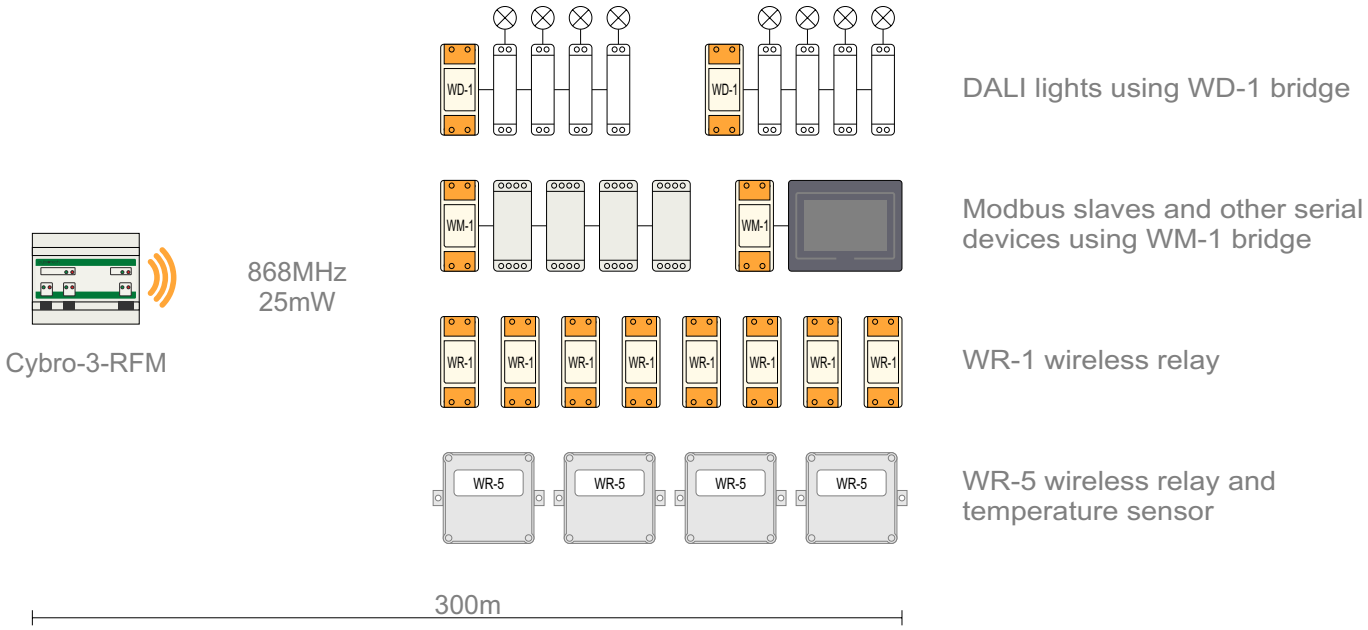
Unlike other modes, PWM outputs must be assigned in ascending order, IO12 to IO15. If there is one PWM output, it must be IO12. Two must be IO12 and IO13, three must be IO12, IO13 and IO14. Any other combination is invalid and it will produce no output.



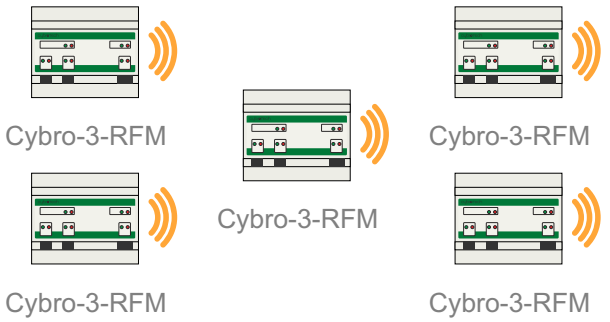
RFM option

Cybro with RFM option can wirelessly control a range of devices which are usually connected by wire.The wireless protocol is using 868MHz narrow band, which allows reasonably secure connection and much longer range than standard Wi-Fi. All the necessary keys are generated automatically, so the setup is done with a single click. Once configured, network is automatically locked and no other devices can interfere.

-long range
-secure
-one-click setup



Cybro to Cybro



Radio interface can be used to exchange simple messages between two or more controllers.

Modbus master

RFM radio modules can be controlled by any modbus RTU master, simply by adding WM-1 device to the RS485 serial channel.

For more details about usage and configuration, check Data Sheet of the particular RFM module.

Technical specifications

Universal digital input (mode=1, ix12..ix15)

Input type	dry contact, pull-up 12V 4mA
Debounce filter	1ms (5x 200us)
Sampling time	5ms
Galvanic isolation	none

Universal digital output (mode=2, qx12..qx15)

Output type	NPN transistor 30V 1A
Permanent load	1.5A qx12+13, 1.5A qx14+15
Protection	short circuit, overheating
Leakage current	250uA
Galvanic isolation	none

Universal analog input 0..10V (mode=4, iw12..iw15)

Input type	0..10V
Measuring range	0..14V
Resolution	12 bits
Readout	mV (10V=10000)
Input resistance	100 kohm
Accuracy	typ. ±1% at 25°C
Temperature drift	50ppm/°C
Galvanic isolation	none
Sampling time	10ms

Universal analog output 0..10V (mode=5, qw12..qw15)

Output type	0..10V
Resolution	12 bits
Readout	mV (10V=10000)
Output current	10mA sink/source
Accuracy	typ. ±1% at 25°C
Temperature drift	50ppm/°C
Galvanic isolation	none
Settling time	10ms

Universal analog input 4..20mA (mode=3, iw12..iw15)

Input type	4..20mA
Measuring range	0..24mA
Resolution	12 bits
Readout	uA (20mA=20000)
Input resistance	250 ohm
Accuracy	typ. ±1% at 25°C
Temperature drift	100ppm/°C
Galvanic isolation	none
Sampling time	10ms

Temperature sensor (mode=6, iw12..iw15)

Input type	ES digital sensor (DS18B20)
Connection protocol	1-wire digital thermometer
Measuring range	-50..+125°C
Readout	0.1°C (245=24.5°C)
Accuracy	typ. ±0.2°C max. ±0.5°C (-10°C to +85°C)
Cable length	50m
Recommended cable	UTP 0.25..0.5mm2

High speed counter (mode=7 or 8, iw12..iw15, qx12..qx15)

Type	single phase (up) or dual phase (up/down)
Counting resolution	1x (single phase) or 4x (dual phase)
Maximum frequency	5kHz (1x) or 2.5kHz (4x), 50% duty cycle
Counter size	16-bit (-32768..32767)
Electrical characteristics	internal pull-up 3.3V 2mA, 24V tolerant

Frequency meter (mode=9, iw12..iw15)

Frequency range	0..5kHz with 50% duty cycle
Integration time	1000ms
Electrical characteristics	internal pull-up 3.3V 2mA, 24V tolerant

Pulse train output (mode=10, qw12..qw15, qx12..qx15, ix12..ix15)

Frequency range	20Hz..2.5kHz
Acceleration/deceleration	0..2500ms
Counter size	16 bits (0..65535 pulses)
Electrical characteristics	same as universal digital output

PWM output (mode=11, qw12..qw15)

Frequency range	20Hz..2.5kHz, 62.7us resolution
Duty cycle	0..100% in 1% increments
Electrical characteristics	same as universal digital output

Digital input (ix00..ix11)

Input type	24V 7mA, bidirectional
Debounce filter	5ms
Sampling time	5ms
Total delay	10ms
Galvanic isolation	230V opto isolated

Digital output (qx00..qx09)

Output type	relay 8A/250VAC or 8A/30VDC resistive
Total delay	5ms
Permanent load	6A each relay 10A common for two relays 25A all relays
Recommended fuse	6A MCB type B each relay 10A MCB type B two relays
Galvanic isolation	4kV QX to 24V supply 230V QX0/1 to QX2/3, QX4/5 to QX6/7 to QX8/9

COM1/COM2

Type	RS232
Galvanic isolation	none
Cable length	10m
Connector	RJ9
Protocol	A-bus slave Modbus RTU slave free programmable

USB

Type	USB 2.0
Profile	USB-SERIAL CH340
Galvanic isolation	none
Connector	micro USB type B
Power supply	5V 100mA, CPU only
Protocol	A-bus slave

Ethernet

Type	10/100M
Auto-MDIX	no
Galvanic isolation	1500V transformer
Connector	RJ45
Protocol	A-bus slave Modbus TCP slave free programmable

CPU board

System clock	100MHz, 10ns instruction
Scan time	max. 100ms, watchdog
Program memory	896Kb for user program
Data memory	64Kb for user variables
Data retention	typ. 7 days at 25°C
RTC accuracy	typ. ±2 sec per day at 25°C
EE write cycles	min. 4,000,000
Supply measurement	0..42V, typ. ±1%
Internal temperature	-50..150°C, ±5°C

IEX-2

Bus load	48 devices (Cybro+47xIEX-2)
Baudrate	20, 50, 100 (def), 250, 500kbps
Galvanic isolation	none
Cable length	100m (100kbps, non-terminated) 300m (100kbps, terminated) 500m (50kbps, terminated)
Connector	RJ9
Protocol	IEX-2 master (CAN 2.0B) A-bus slave

RFM (radio frequency module)

Frequency band	ISM 868MHz (EU)
Subband	L 866.8MHz, 1% utilization
Modulation	FSK, 160kHz bandwidth
Listen before talk	yes, delay up to 20ms
Group address	32-bit
Message delay	5ms from send to receive
Output power	25mW
Operating range	300m with optical visibility

ENO (EnOcean module)

Frequency band	ISM 868MHz (EU)
Standard	ISO/IEC 14543-3-10

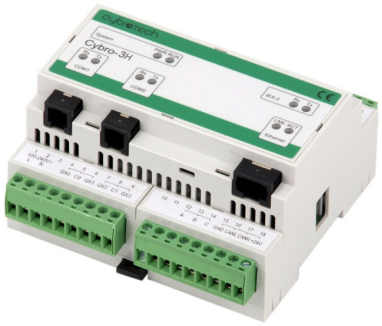
General

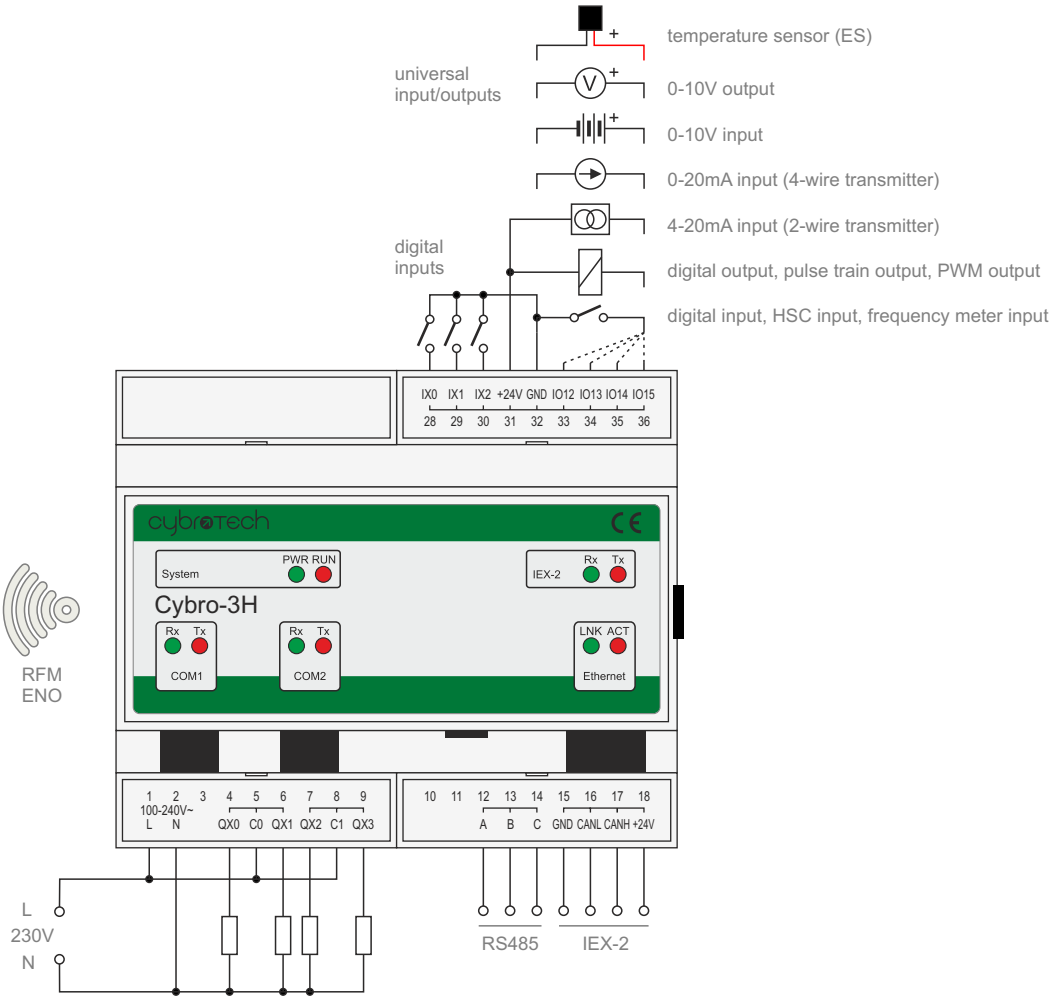
Operating conditions	0..50°C, 0..85% rh nc
Storage temperature	-40..85°C
Ambient pollution level	2
Power supply	24V (18..28V)
Power consumption	50mA (no load) 180mA (10 relays, 4x 10Vout)
IEX-2 power output	24V 2A resettable fuse
Fuse trip time	10s at 200% overload
Fuse recover time	48 hours with power off
Fuse life	100 cycles
Terminals	2.5mm2, 15A, removable
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	280g
Degree of protection	IP20
Installation category	III
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

Cybro-3H

programmable controller
3 digital inputs
4 relay outputs 8A
4 universal input/outputs
Ethernet, USB, IEX-2
2 RS232, 1 RS485
RFM free-programmable radio
EnOcean gateway
230V AC power supply

building





RS485 port depends on CPU version:

CYCPU3 v1.3: COM1
CYCPU3 v1.4: COM1
CYCPU3 v1.5: COM3
CYCPU3 v1.7: COM3

With older versions, RS485 is connected in parallel to the existing COM1. New versions have third, fully independent serial port.
To check the version, remove top cover. It is printed on top of the pcb, above RUN led.

Technical specifications

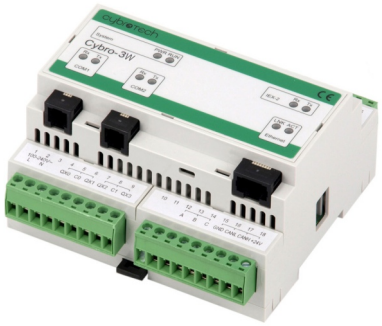
Input type (ix00..ix02)	dry contact, internal pull-up 12V 2mA
Galvanic isolation	none
COM3 interface	RS485 (terminals)
Galvanic isolation	none or 1kV (ISO option)
Cable length	50 or 500m (ISO option)
Transmit/receive	automatic switching
Power supply	100..240VAC, 50/60Hz
Power consumption	1W no load, 10W max.
Total power output	24V 200mA (IEX-2+24V output)
Standards	EN 60730-1

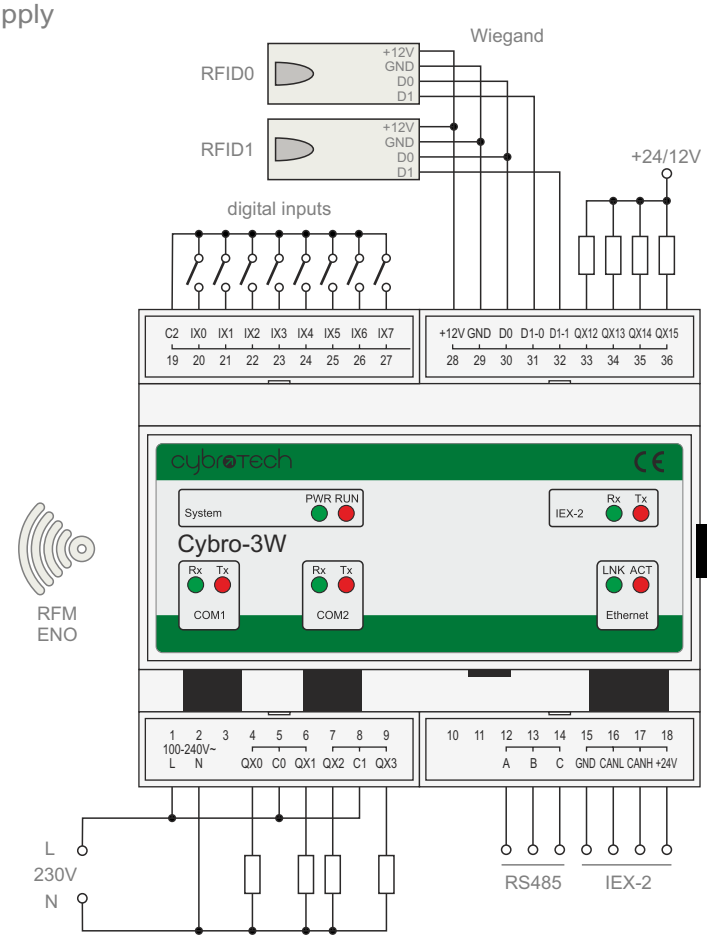
Other specifications are common for all Cybro-3 models.

Cybro-3W

programmable controller
8 digital inputs
4 relay outputs 8A
4 NPN outputs 1A
Ethernet, USB, IEX-2
2 RS232, 1 RS485
2 Wiegand interface
RFM free-programmable radio
EnOcean gateway
230V AC power supply

building





RS485 port depends on CPU version:

CYCPU3 v1.3: COM1
CYCPU3 v1.4: COM1
CYCPU3 v1.5: COM3
CYCPU3 v1.7: COM3

With older versions, RS485 is connected in parallel to the existing COM1. New versions have third, fully independent serial port.
To check the version, remove top cover. It is printed on top of the pcb, above RUN led.

Technical specifications

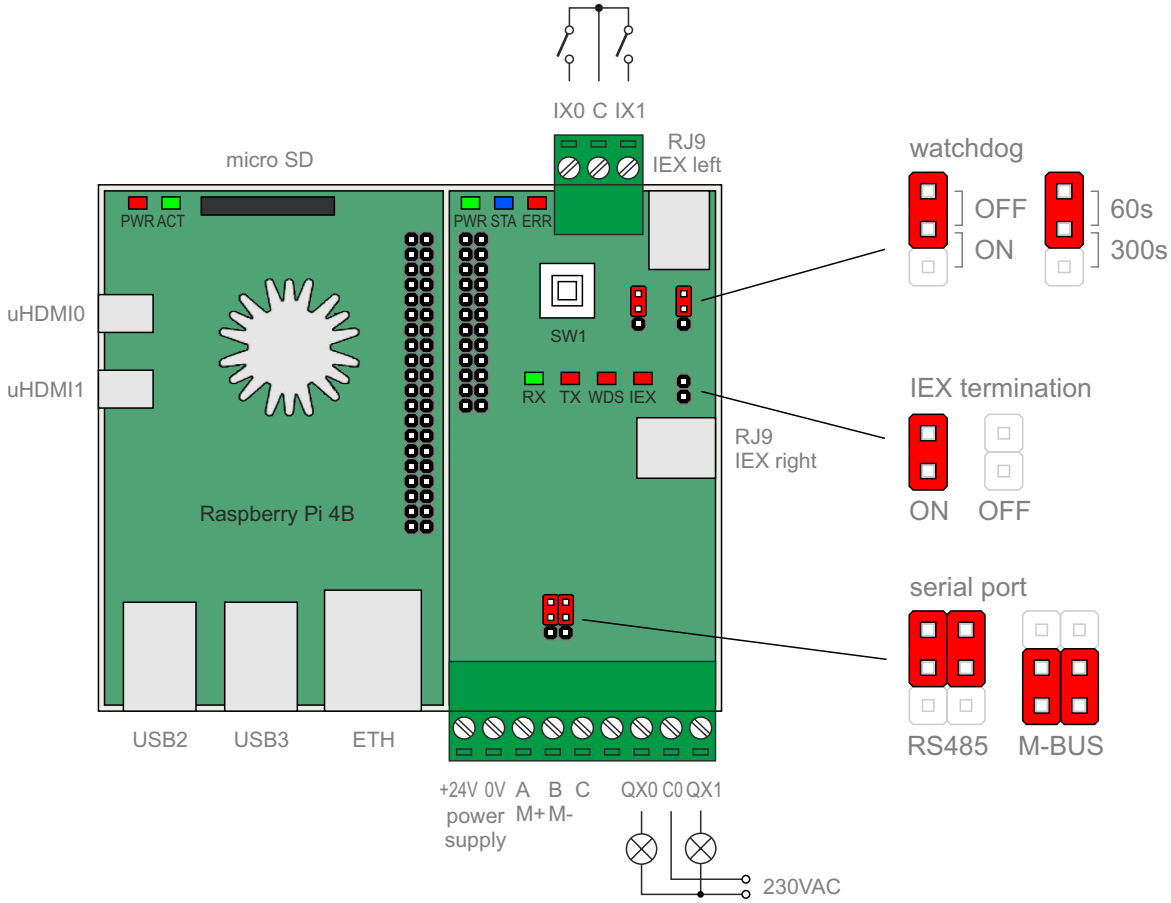
Input type (ix00..ix07)	dry contact, internal pull-up 12V 2mA
Galvanic isolation	none
Output type (qx12..qx15)	NPN transistor 30V 1A
Permanent load	1.5A qx12+qx13 and 1.5A qx14+qx15
Protection	short circuit, overvoltage, overheating
Galvanic isolation	none
COM3 interface	RS485 (terminals)
Galvanic isolation	none or 1kV (ISO option)
Cable length	50 or 500m (ISO option)
Transmit/receive	automatic switching
Wiegand input	active low, internal pull-up 3V3 1mA
Timing	20us min pulse, 20ms max spacing
Power supply	100..240VAC, 50/60Hz
Power consumption	1W no load, 10W max.
IEX-2 power output	24V 250mA
Wiegand power output	12V 500mA
Total power output	6W (IEX-2+Wiegand)
Standards	EN 60730-1

Other specifications are common for all Cybro-3 models.

Cybro-Pi4

Raspberry Pi 4B 2Gb
hardware watchdog timer
PiCAN2 compatible controller
RS485/M-bus serial interface
24-to-5V voltage regulator
CPU heatsink
1 pushbutton
2 digital inputs
2 relay outputs 8A

building



Input/output mapping

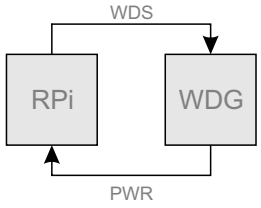
PWR	power supply	+5V	-	connected to +5V power supply
STA	device status	GPIO2/SDA	0-active	digital output, controlled by user application
ERR	device error	GPIO3/SCL	0-active	digital output, controlled by user application
RX	serial receive	GPIO15/RXD	0-active	controled by primary UART (/dev/serial0)
TX	serial transmit	GPIO14/TXD	0-active	controled by primary UART (/dev/serial0)
WDS	watchdog signal	GPIO27	0-active	digital output, controlled by user application
IEX	CAN bus activity	CANH/CANL	0-active	controlled by CAN controller (SPI0/CAN0)
SW1	push button	GPIO4	0-pressed	digital input, readable by user application
IX0	digital input	GPIO17	0-closed	digital input, readable by user application
IX1	digital input	GPIO18	0-closed	digital input, readable by user application
RE0	relay output	GPIO23	1-active	digital output, controlled by user application
RE1	relay output	GPIO24	1-active	digital output, controlled by user application

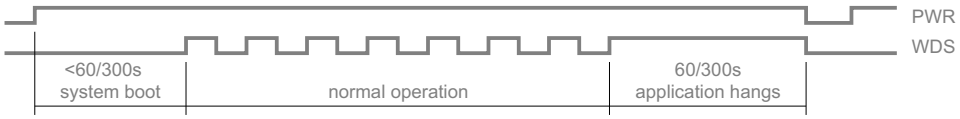
Watchdog settings

Watchdog is hardware device for monitoring your application. Application sends a continuous stream of pulses on WDS line. When pulsing is stopped for any reason, watchdog will reset the Raspberry, preventing application to permanently lock up.

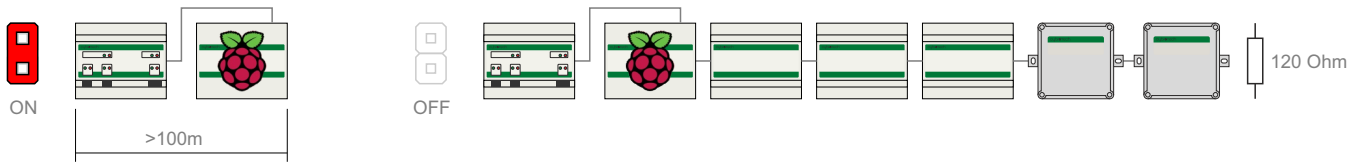
Watchdog can be configured to 60 or 300 seconds, depending on boot time. Default is disabled. Minimum WDS pulse width is 500+500us, recommended width is 500+500ms.

JP1	JP0	period	description
OFF	-	-	watchdog disabled
ON	60s	60s	watchdog enabled
ON	300s	300s	watchdog enabled



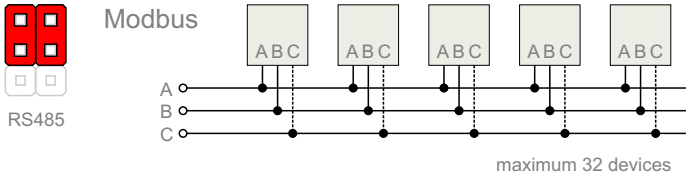


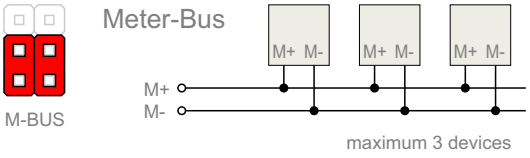
IEX termination



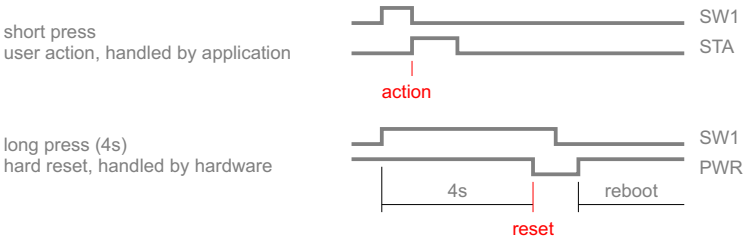
When termination resistor is already connected at the end of the line, jumper must be in OFF position. When line is shorter ther 100m, termination doesn't matter.

Serial port (/dev/serial0)





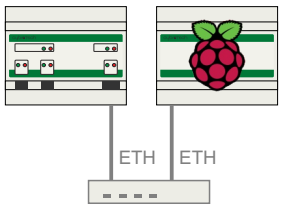
Push button



Push button is accessable using a small 2mm screwdriver. It can be used to start an action (short press), or to reboot Raspberry Pi (long press).

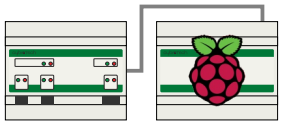
Raspberry-Cybro connection

1. TCP/IP



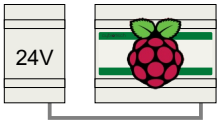
Raspberry read and write Cybro variables through local TCP/IP network

2. IEX/CAN

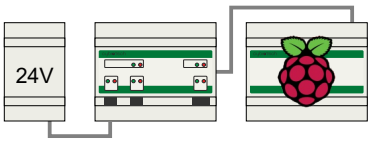


Raspberry read and write Cybro variables through IEX bus, using the integrated CAN controller

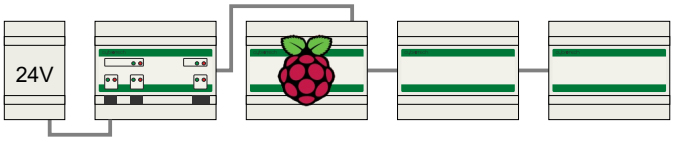
Power supply



Raspberry alone

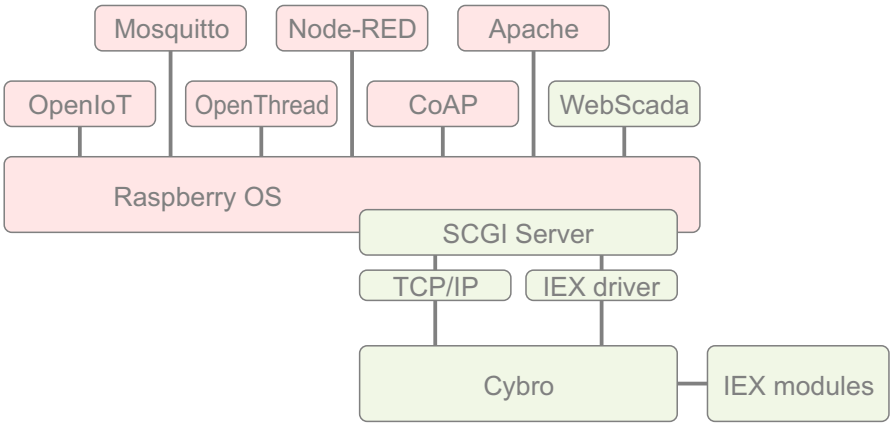


Raspberry and Cybro



Raspberry, Cybro and IEX modules

Possible applications



Combine the abundance of Raspberry projects with reliability of Cybro controller and expansion modules

Quick start

1. Choose OS, write RPi bootable image on uSD
2. Connect power supply and communication
3. Install SCGI server and (optionally) web scada
4. Install Raspberry project you are interested in
5. Write code to integrate Cybro into the project

CPU heatsink

Internal heatsink brings the CPU temperature down, providing longevity and reliable operation. However, when CPU is fully loaded, external cooling fan may be needed to prevent thermal trottling.

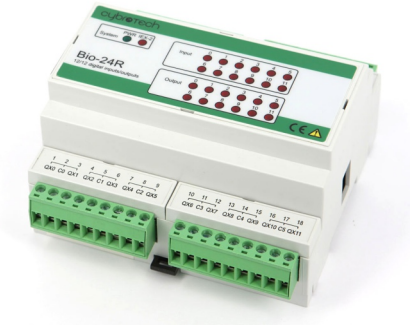
Technical specifications

Input type	dry contact, internal pull-up 12V 2mA
Galvanic isolation	none
Output type	relay 8A/250VAC resistive, normally open
Continuous load	6A each relay 10A both relays
Galvanic isolation	4kV, relay contact to 24V power supply
Power supply	24V (18..28V), 120mA typ., 400mA max.
Mounting	DIN rail (35mm)
Dimensions	106x107x32mm
Weight	200g
Degree of protection	IP20

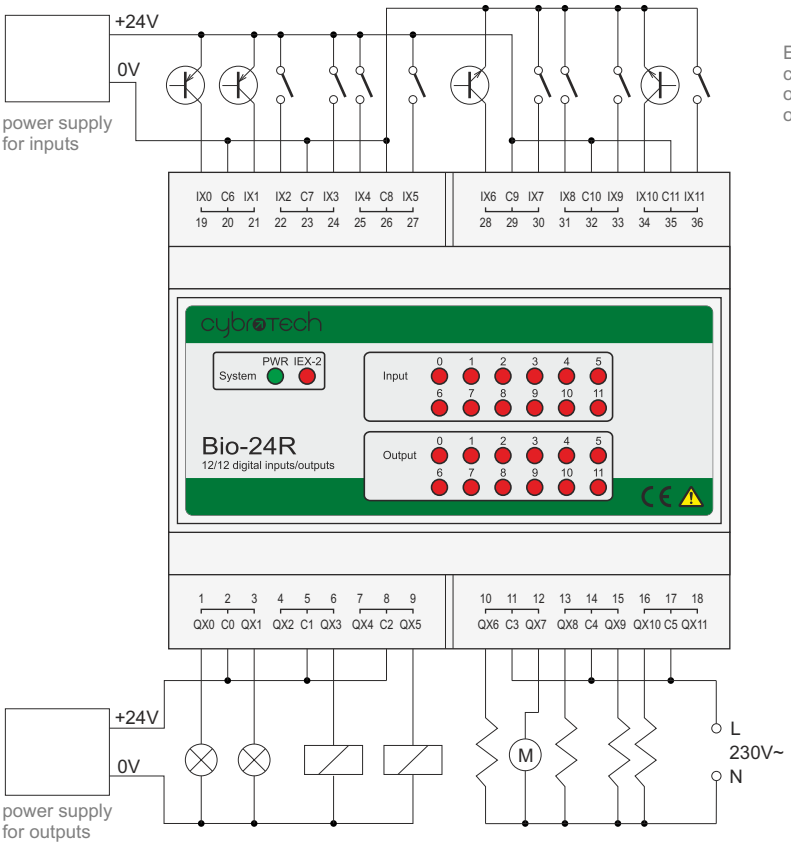
Bio-24R

IEX-2 module
12 opto-coupler inputs 24V
12 relay outputs 5A

industrial building



Wiring diagram



Each group of two inputs (IX0/1, IX2/3...) can be connected as either common GND or common +24V. Wiring diagram shows only one of possible combinations.

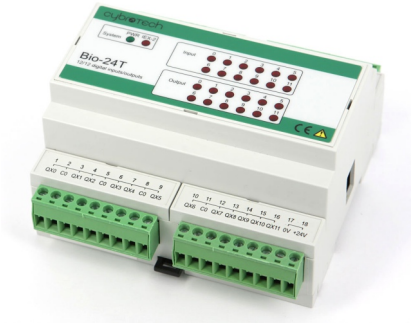
Technical specifications

Input type	24V 7mA, opto isolated, bidirectional
Debounce filter	0, 5 or 100ms, software selectable
Output type	relay 5A/250VAC or 3A/30VDC resistive
Contact type	normally open
Continuous load	3A each relay 36A all relays
Power supply	24V (18..28V), 260mA (20mA+11mA*active outputs+9mA*active inputs)
Galvanic isolation	4kV between inputs and internal circuit 4kV relay contact
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	320g
Degree of protection	IP20
Installation category	II
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

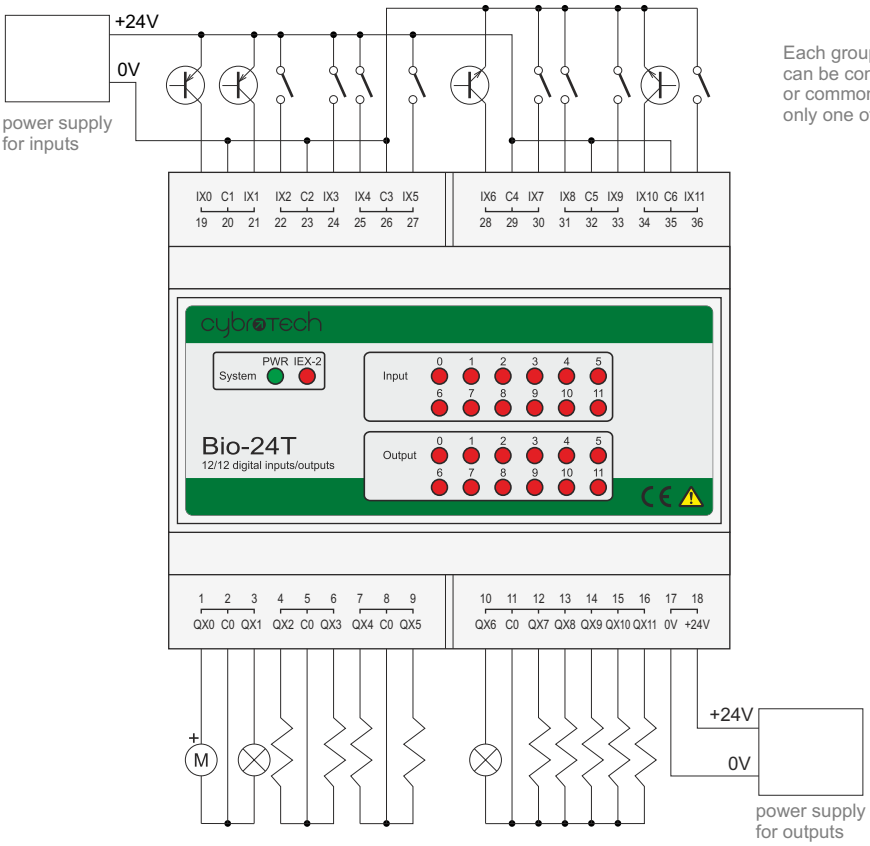
Bio-24T

IEX-2 module
12 opto-coupler inputs 24V
12 opto-isolated PNP outputs 1A

industrial building



Wiring diagram



Each group of two inputs (IX0/1, IX2/3...) can be connected as either common GND or common +24V. Wiring diagram shows only one of possible combinations.

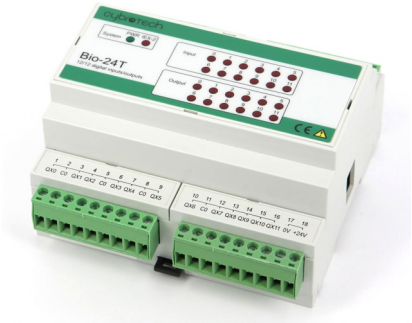
Technical specifications

Input type	24V 7mA, opto isolated, bidirectional
Debounce filter	0, 5 or 100ms, software selectable
Output type	PNP transistor 30V 1A
Protection	short circuit, overcurrent and reverse supply
Power supply	24V (18..28V), 80mA
Galvanic isolation	4kV between inputs and internal circuit 4kV between internal circuit and output transistors
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	270g
Degree of protection	IP20
Installation category	II
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

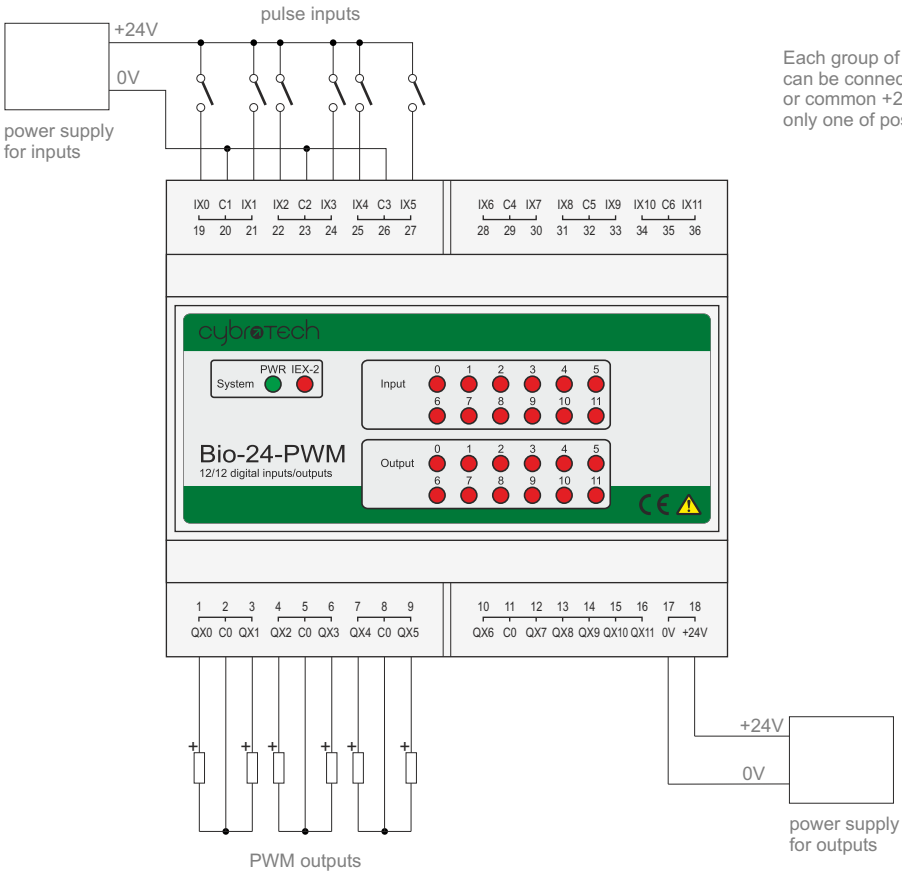
Bio-24PWM

IEX-2 module
12 opto-coupler inputs 24V (4 pulse counters)
12 opto-isolated PNP outputs 1A (6 PWM outputs)

industrial building



Wiring diagram



Each group of two inputs (IX0/1, IX2/3...) can be connected as either common GND or common +24V. Wiring diagram shows only one of possible combinations.

Technical specifications

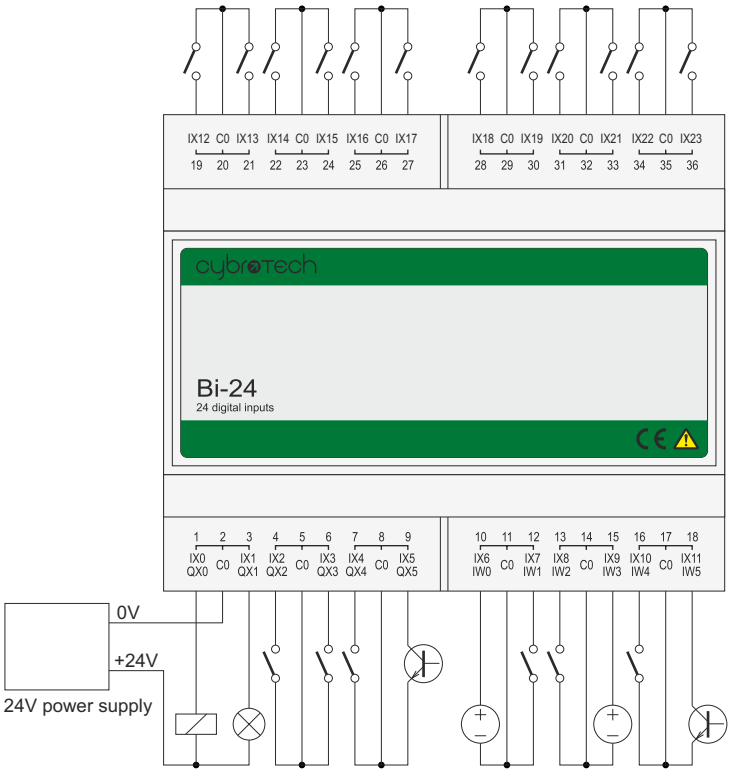
Input type	24V 7mA, opto isolated, bidirectional
Pulse counter	IX0..IX3 (4 independent counters)
Input frequency	max. 1kHz, 50% duty cycle
Output type	PNP transistor 30V 1A
Protection	overload, short circuit and reverse supply
PWM outputs	QX0..QX5 (6 independent outputs)
PWM frequency	250Hz or 500Hz, software selectable
PWM range	0..100% in 40 steps (250Hz), 0..100% in 20 steps (500Hz)
Power supply	24V (18..28V), 80mA
Galvanic isolation	4kV between inputs and internal circuit 4kV between internal circuit and output transistors
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	270g
Degree of protection	IP20
Installation category	II
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

Bi-24

IEX-2 module
6 digital inputs or NPN outputs 1A
6 digital or analog inputs
12 digital inputs

building

Wiring diagram



All common terminals are internally connected to GND. Wiring diagram is an example, it shows only one of possible combinations.

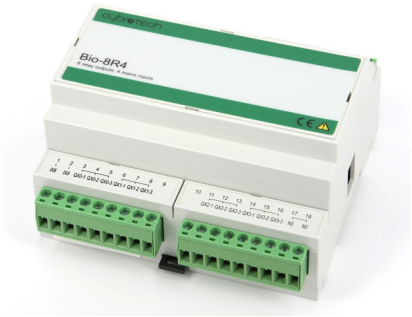
Technical specifications

Input type	dry contact, internal pull-up 12V 2mA
Debounce filter	15ms (30Hz max readout)
Analog input	0..10V 6kohm
Resolution	10 bits (0..1023)
Accuracy	typ. 2% of FSR at 25°C
Output type	NPN transistor 1A 30V
Protection	short circuit, overcurrent, voltage clamp
Power supply	24V (18..28V), 60mA
Galvanic isolation	none
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	250g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 60730-1

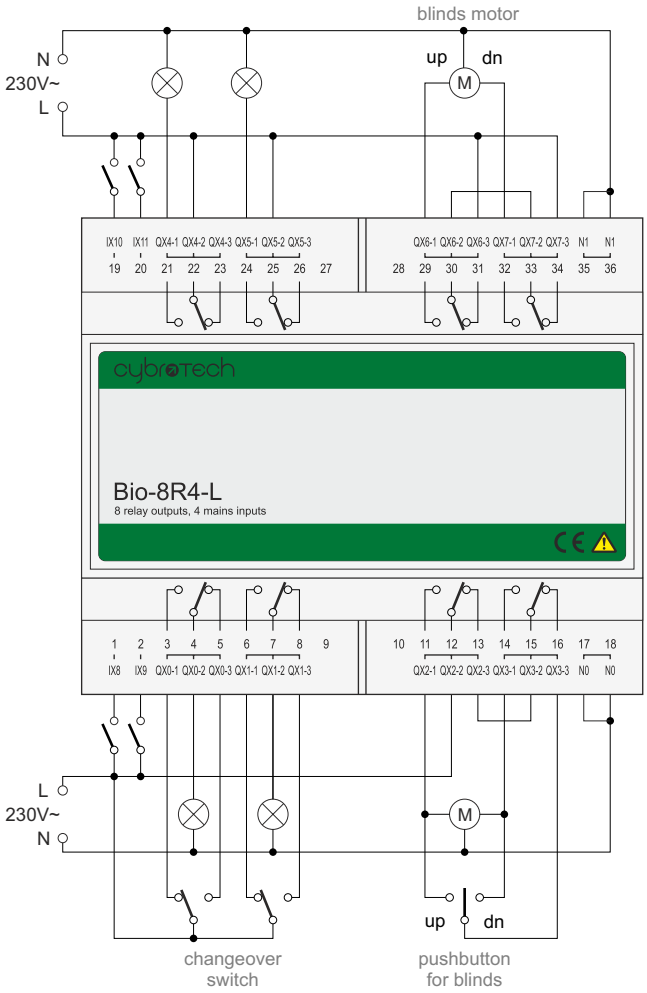
Bio-8R4

IEX-2 module
4 opto-coupler inputs 230V
8 relay outputs 16A with mains sense

industrial building



Wiring diagram



Mains sense is connected to the relay common contact. Wiring diagram is an example, it shows only one of possible combinations.

Technical specifications

Input type	230VAC 1mA, opto isolated
Output type	relay 16A/250VAC resistive
Continuous load	15A per relay 75A for all relays together
Power supply	24V (18..28V), 160mA (20mA+17mA*number of active relays)
Galvanic isolation	5kV between inputs and internal circuit 5kV between internal circuit and relay contacts
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	360g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

Order code

Bio-8R4-L	power relay for lights and blinds

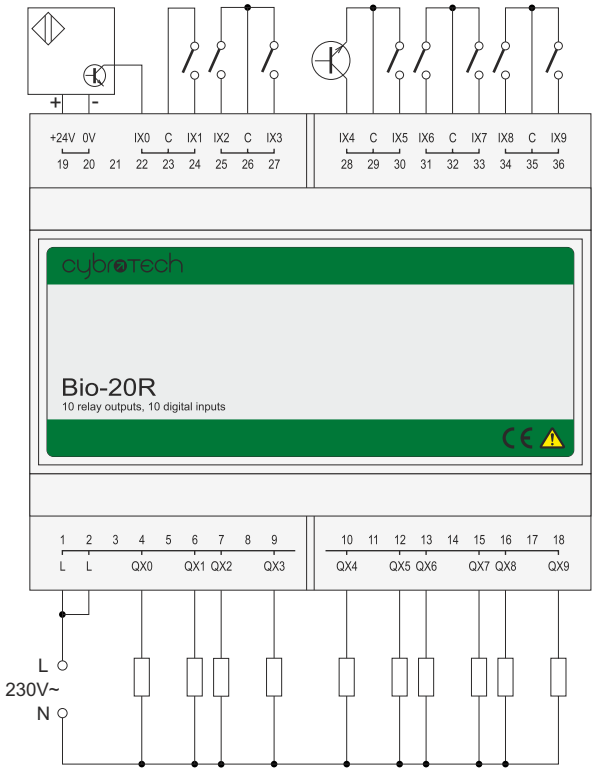
Bio-20R

IEX-2 module
10 digital inputs
10 relay outputs 8A

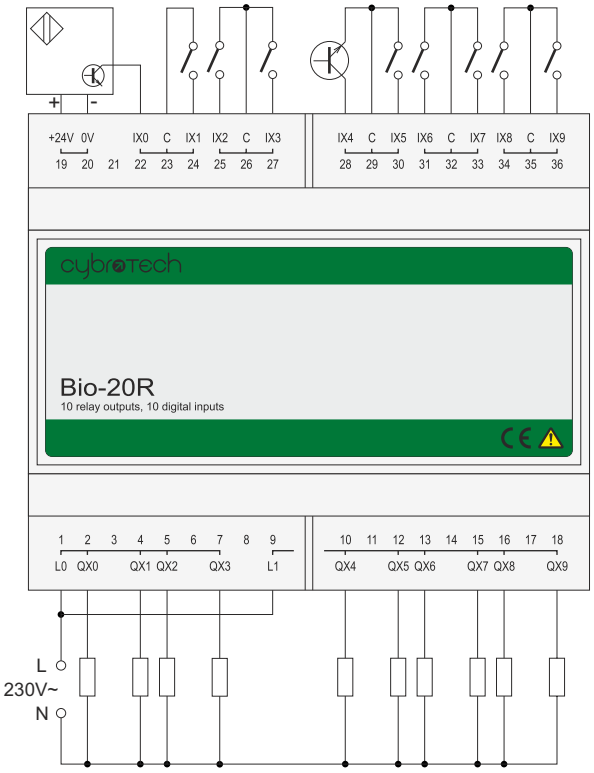
building

Wiring diagram

mk1 or no revision marking



mk2



Technical specifications

Input type	dry contact, internal pull-up 12V 2mA
Output type	relay 8A/250VAC or 8A/30VDC resistive
Contact type	normally open
Continuous load	6A each relay 20A all relays (mk1) 12A each relay group (mk2)
Power supply	24V (18..28V), 120mA (30mA+9mA*number of active outputs)
Galvanic isolation	4kV between internal circuit and relay contact
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	106x107x58mm
Weight	300g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 60730-1

AiR-12

IEX-2 module
12 RTD inputs

industrial building

Wiring diagram

2-wire

3-wire

Terminals

No	Name	Description
1	IW0	iw000
2	C	common for iw000 & iw001
3	IW1	iw001
4	IW2	iw002
5	C	common for iw002 & iw003
6	IW3	iw003
7	IW4	iw004
8	C	common for iw004 & iw005
9	IW5	iw005
10	IW6	iw006
11	C	common for iw006 & iw007
12	IW7	iw007
13	IW8	iw008
14	C	common for iw008 & iw009
15	IW9	iw009
16	IW10	iw010
17	C	common for iw010 & iw011
18	IW11	iw011

Technical specifications

In 3-wire mode, temperature is iw0, iw2, iw4, iw6, iw8 and iw10; wire resistance is iw1, iw3, iw5, iw7, iw9 and iw11.

For a best accuracy, unused inputs must be short-circuited.

If measurement is invalid, check variable program_error. Active means either program or calibration data is corrupted.

Input type	Pt100/1000 (DIN751) auto selectable, measuring range -100..300°C Ni100/1000 (DIN43760) auto selectable, measuring range -50..160°C Ni100/1000 (Landis & Gyr) auto selectable, measuring range -50..160°C potentiometer 0..2000ohm
Sensor current	190uA (each sensor)
Wire resistance	20ohm max. (3-wire mode)
Resolution	14 bits in 0.1% mode 12 bits in 0.5% and 1% mode
Temperature drift	+/-0.01%/°C of measuring range
Calibration reference	150.00ohm, 1500.0ohm

Input mode

mode	no.ch	connection	accuracy	scan time	integration time	auto calibration
0	12	2-wire	0.1%	1120ms	60ms	each cycle
1	12	2-wire	1%	480ms	20ms	each cycle
2	12	2-wire	5%	360ms	20ms	every 10 minutes
3	6	2-wire	0.1%	700ms	60ms	each cycle
4	6	2-wire	1%	300ms	20ms	each cycle
5	6	2-wire	5%	180ms	20ms	every 10 minutes
6	4	2-wire	0.1%	560ms	60ms	each cycle
7	4	2-wire	1%	240ms	20ms	each cycle
8	4	2-wire	5%	120ms	20ms	every 10 minutes
9	2	2-wire	0.1%	420ms	60ms	each cycle
10	2	2-wire	1%	180ms	20ms	each cycle
11	2	2-wire	5%	60ms	20ms	every 10 minutes
12	1	2-wire	0.1%	350ms	60ms	each cycle
13	1	2-wire	1%	150ms	20ms	each cycle
14	1	2-wire	5%	30ms	20ms	every 10 minutes
15	6	3-wire	0.1%	1120ms	60ms	each cycle
16	3	3-wire	0.1%	700ms	60ms	each cycle
17	2	3-wire	0.1%	560ms	60ms	each cycle
18	1	3-wire	0.1%	420ms	60ms	each cycle

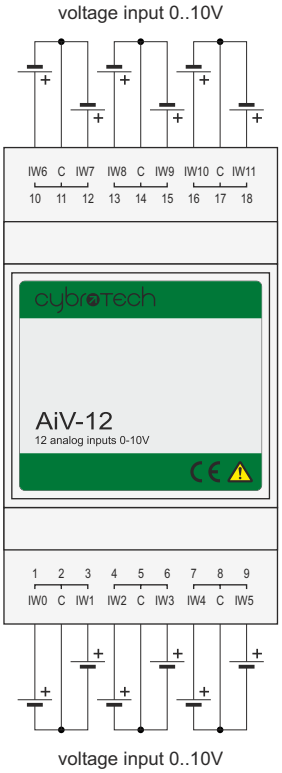
Power supply	24V (22..28V), 50mA
Galvanic isolation	1kV beetwen digital and analog circuit no isolation between chanels
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	53x107x58mm
Weight	160g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

AiV-12

IEX-2 module
12 analog inputs 0..10V

industrial building

Wiring diagram



Terminals

No	Name	Description
1	IW0	iw000
2	C	common for iw000 & iw001
3	IW1	iw001
4	IW2	iw002
5	C	common for iw002 & iw003
6	IW3	iw003
7	IW4	iw004
8	C	common for iw004 & iw005
9	IW5	iw005
10	IW6	iw006
11	C	common for iw006 & iw007
12	IW7	iw007
13	IW8	iw008
14	C	common for iw008 & iw009
15	IW9	iw009
16	IW10	iw010
17	C	common for iw010 & iw011
18	IW11	iw011

Technical specifications

Input type	0..10V
Input resistance	10K
A/D converter	V/f conversion with auto calibration
Resolution	13 bits in 0.1% mode 11 bits in 0.5% and 1% mode
Temperature drift	+-0.01%/°C of measuring range
Scan time	30ms..980ms, depends on input mode
Integration time	60ms/20ms, depends on input mode
Calibration reference	10.000V

Input mode

mode	no.ch	accuracy	scan time	integration time	auto calibration
0	12	0.1%	980ms	60ms	each cycle
1	12	1%	420ms	20ms	each cycle
2	12	5%	360ms	20ms	every 10 minutes
3	6	0.1%	560ms	60ms	each cycle
4	6	1%	240ms	20ms	each cycle
5	6	5%	180ms	20ms	every 10 minutes
6	4	0.1%	420ms	60ms	each cycle
7	4	1%	180ms	20ms	each cycle
8	4	5%	120ms	20ms	every 10 minutes
9	2	0.1%	280ms	60ms	each cycle
10	2	1%	120ms	20ms	each cycle
11	2	5%	60ms	20ms	every 10 minutes
12	1	0.1%	210ms	60ms	each cycle
13	1	1%	90ms	20ms	each cycle
14	1	5%	30ms	20ms	every 10 minutes

Power supply	24V (22..28V), 50mA
Galvanic isolation	1kV between digital and analog circuit no isolation between chanels
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	53x107x58mm
Weight	160g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

AiC-12

IEX-2 module
12 analog inputs 0..20mA

industrial building

Wiring diagram

Terminals

No	Name	Description
1	IW0	iw000
2	C	common for iw000 & iw001
3	IW1	iw001
4	IW2	iw002
5	C	common for iw002 & iw003
6	IW3	iw003
7	IW4	iw004
8	C	common for iw004 & iw005
9	IW5	iw005
10	IW6	iw006
11	C	common for iw006 & iw007
12	IW7	iw007
13	IW8	iw008
14	C	common for iw008 & iw009
15	IW9	iw009
16	IW10	iw010
17	C	common for iw010 & iw011
18	IW11	iw011

Technical specifications

Input type	0..20mA
Input resistance	50ohm
A/D converter	V/f conversion with auto calibration
Resolution	13 bits in 0.1% mode 11 bits in 0.5% and 1% mode
Temperature drift	+-0.01%/°C of measuring range
Scan time	30ms..980ms, depends on input mode
Integration time	60ms/20ms, depends on input mode
Calibration reference	10.000mA

Input mode

mode	no.ch	accuracy	scan time	integration time	auto calibration
0	12	0.1%	980ms	60ms	each cycle
1	12	1%	420ms	20ms	each cycle
2	12	5%	360ms	20ms	every 10 minutes
3	6	0.1%	560ms	60ms	each cycle
4	6	1%	240ms	20ms	each cycle
5	6	5%	180ms	20ms	every 10 minutes
6	4	0.1%	420ms	60ms	each cycle
7	4	1%	180ms	20ms	each cycle
8	4	5%	120ms	20ms	every 10 minutes
9	2	0.1%	280ms	60ms	each cycle
10	2	1%	120ms	20ms	each cycle
11	2	5%	60ms	20ms	every 10 minutes
12	1	0.1%	210ms	60ms	each cycle
13	1	1%	90ms	20ms	each cycle
14	1	5%	30ms	20ms	every 10 minutes

Power supply	24V (22..28V), 50mA
Galvanic isolation	1kV between digital and analog circuit no isolation between chanels
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	53x107x58mm
Weight	160g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

AoV-12

IEX-2 module
12 analog outputs 0..10V

industrial building

Wiring diagram

Terminals

No	Name	Description
1	QW0	qw000
2	C	common for qw000 & qw001
3	QW1	qw001
4	IW2	qw002
5	C	common for qw002 & qw003
6	QW3	qw003
7	QW4	qw004
8	C	common for qw004 & qw005
9	QW5	qw005
10	QW6	qw006
11	C	common for qw006 & qw007
12	QW7	qw007
13	QW8	qw008
14	C	common for qw008 & qw009
15	QW9	qw009
16	QW10	qw010
17	C	common for qw010 & qw011
18	QW11	qw011

Technical specifications

Output type	0..10V
Output current	max. 10mA per chanel max. 70mA for all chanels
Resolution	8 bits
Accuracy	1% of FSR
Temperature drift	+-0.01%/°C of output range
Settling time	50ms
Power supply	24V (22..28V), 120mA (50mA+output current)
Galvanic Isolation	1kV between digital and analog circuit no isolation between chanels
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Dimensions	53x107x58mm
Weight	160g
Degree of protection	IP20
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

OP-2

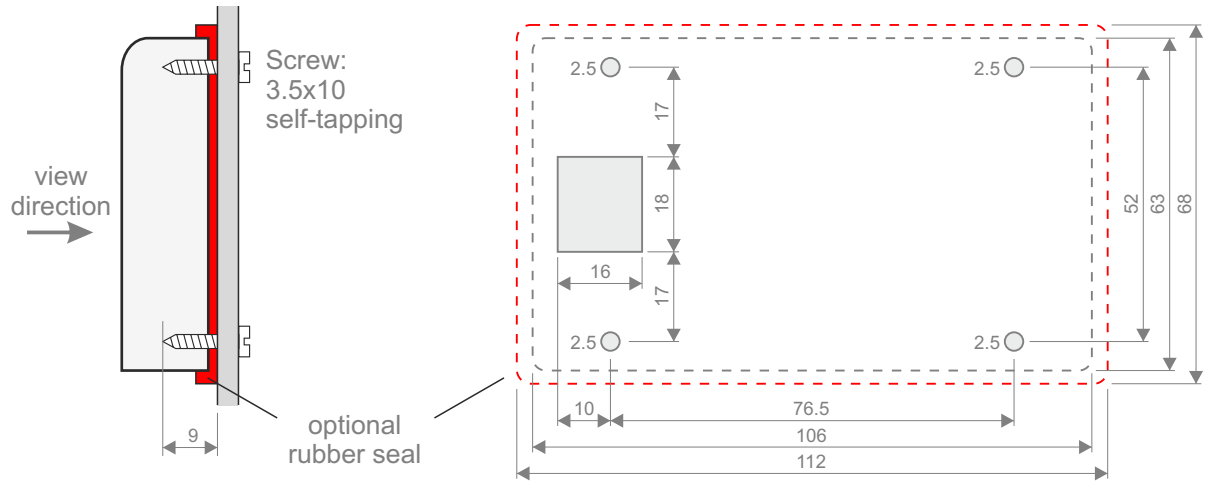
IEX-2 module, operator panel
LCD display 2x16 characters, black/green

industrial building

I/O table

key_f	Indicate status of operator panel F key (0-released, 1-pressed).
key_e	Indicate status of operator panel E (enter) key (0-released, 1-pressed). Always zero while mask is active.
key_dn	Indicate status of operator panel down key (0-released, 1-pressed). Always zero while mask is active.
key_up	Indicate status of operator panel up key (0-released, 1-pressed). Always zero while mask is active.
general_error	A one or more system errors occured (timeout, program or bus error).
timeout_error	Communication failed, no messages are coming from the module.
program_error	Internal or configuration error detected, module is not functional.
bus_error	Module detected a number of communication errors, but it is still working.
current_mask	Indicates current mask number (read only). Zero means no mask is active.
next_mask	Write a mask number to send a new mask to the operator panel. After mask is sent, will be automatically set to -1.
lcd_dimmer	Intensity of LCD backlight (0-maximum, 255-dark).
lcd_timeout	Time for LCD backlight to start dimming (0..120s).

Mounting



Technical specifications

IEX-2 connection	RJ9
Display	LCD 2x16 characters
Backlight	green LED, adjustable 0..100%
Power supply	24V (18..28V), 40mA
Operation conditions	0..50°C, 0..85% rh non-condensing
Dimensions	106x63x24mm
Weight	120g
Degree of protection	IP54 (IP40 without rubber seal)
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

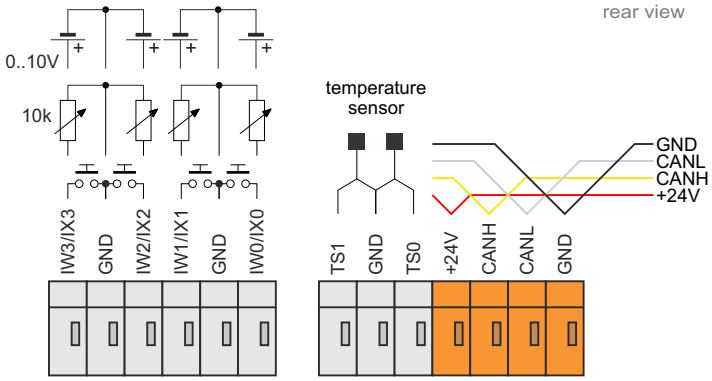
OP-4

IEX-2 module, operator panel
LCD display 2x20 characters, white/blue
light sensor, IR receiver, beeper
2 temperature sensor inputs
4 switch/potentiometer inputs

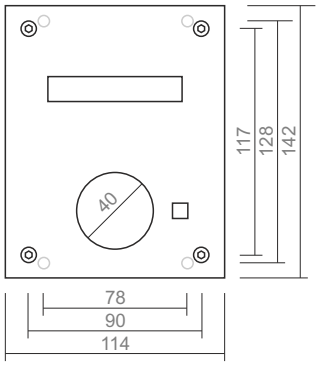
building

Wiring diagram

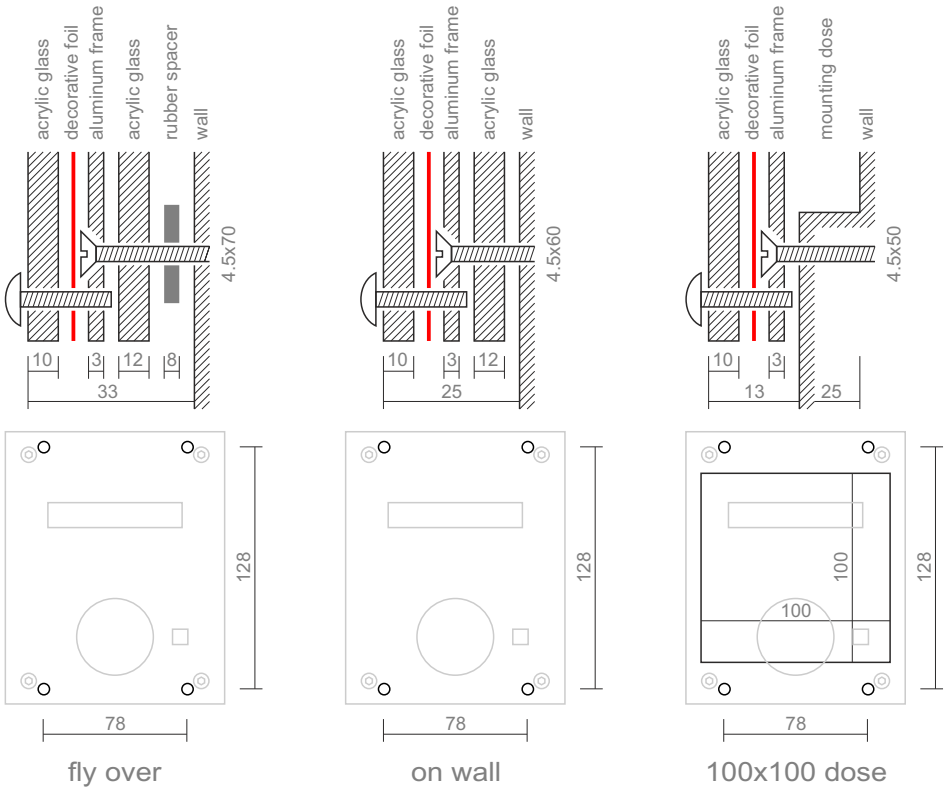
rear view



Dimensions



Mounting



Technical specifications

Display	LCD 2x20 characters	Power supply	24V (18..28V), 50mA
Backlight	white LED, adjustable 0..100%	Degree of protection	IP20
IR receiver	RC5 36kHz, receiving distance 5m	Operating conditions	0..50°C, 0..85% rh non-condensing
Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023)	Storage temperature	-20..75°C
		Dimensions	142x114x25mm
External temperature sensor	ES-P, ES-B or ES-W	Weight	600g
Cable length	50m	Level of ambient pollution	2
Light sensor	day/night mode switching	Standards	EN 60730-1

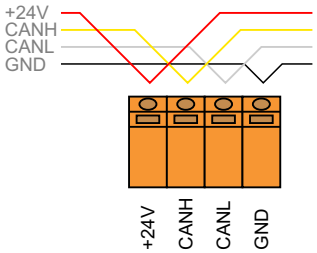
OP-8

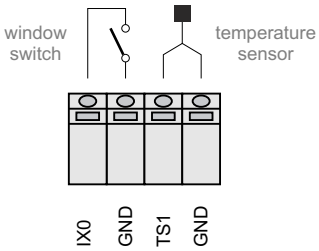
IEX-2 module, touch operator panel
LCD display 2x20 characters, white/blue
temperature, humidity and light sensor
IR receiver, beeper
1 switch/potentiometer input
1 temperature sensor input

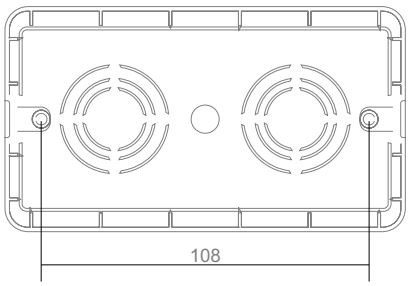
building

Wiring diagram

rear view







Order code

OP-8	operator panel
OP-8-CYR	operator panel with cyrillic display

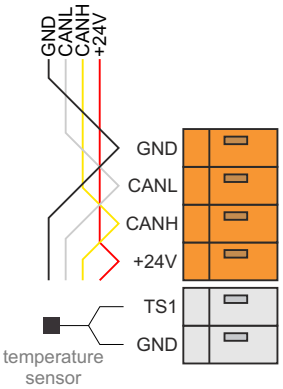
Technical specifications

Display	LCD 2x20 characters
Characters size	3x5mm
Keys	5 touch keys, tactile feedback
Backlight	blue LED, adjustable 0..100%
IR receiver	RC5 36kHz, receiving distance 5m
Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023)
Temperature measurement	range: 0°C to +50°C error: ±0.5°C typ. (0°C to +50°C, backlight at 20%) ±2°C max. (0°C to +50°C) resolution: 0.1°C (12 bit) readout: 0.1°C (254 equals 25.4°C)
Humidity measurement	range: 0..100% rh, non-condensing error: ±2% rh @ 25°C response time 15s stability ±1% rh @ 50% rh in 5 years resolution 1% (7 bit) readout 1% rh (45 equals 45% rh)
External temperature sensor	ES-P, ES-B or ES-W
Cable length	50m
Power supply	24V (18..28V), 50mA
Degree of protection	IP20
Operating conditions	0..50°C, 0..85% rh non-condensing
Storage temperature	-20..75°C
Mounting	M4 installation box
Dimensions	144x80x7mm
Weight	200g
Level of ambient pollution	2
Standards	EN 60730-1

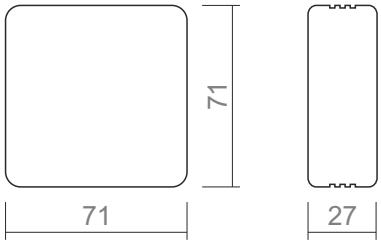
TS-H

IEX-2 module
temperature and humidity sensor
1 temperature sensor input

Wiring diagram



Dimensions



Mounting

Technical specifications

Temperature measurement	range: 0°C to +50°C error: ±0.5°C typ. (0°C to +50°C) ±2°C max. (0°C to +50°C) resolution: 0.1°C (12 bit) readout: 0.1°C (254 equals 25.4°C)
Humidity measurement	range: 0..100% rh, non-condensing error: ±2% rh @ 25°C stability ±1% rh @ 50% rh in 5 years resolution 1% (7 bit) readout 1% rh (45 equals 45% rh)
External temperature sensor	ES-P, ES-B or ES-W
Cable length	10m
Power supply	24V (18..28V), 15mA
Degree of protection	IP20
Operating conditions	0..50°C, 0..85% rh non-condensing
Storage temperature	-20..75°C
Mounting	wall surface
Dimensions	71x71x27mm
Weight	80g
Level of ambient pollution	2
Standards	EN 60730-1

Order code

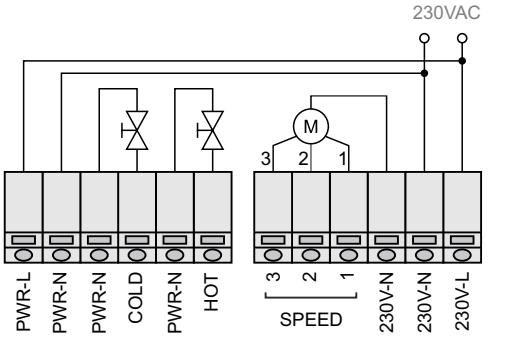
TS	temperature sensor
TS-H	temperature sensor + humidity

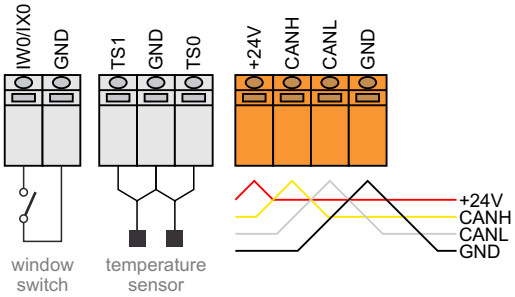
FC

IEX-2 module, fan-coil controller
3 relay outputs 5A (fan speed)
2 relay outputs 5A (valve)
1 binary/analog input
2 temperature sensor inputs

building

Wiring diagram





Technical specifications

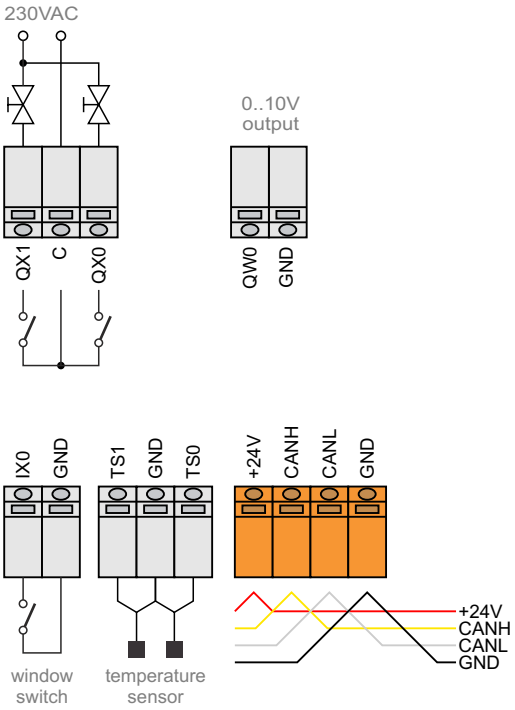
Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023)
Output type	relay 5A/250VAC resistive
External temperature sensor	ES-P, ES-B or ES-W
Cable length	10m
Power supply	24V (18..28V), 100mA (25mA+15mA*number of active outputs)
Galvanic isolation	4kV between internal circuit and relay contacts
Degree of protection	IP20
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Mounting	inside the fan coil unit
Dimensions	108x86x46mm
Weight	200g
Standards	EN 60730-1

FC-2

IEX-2 module, fan-coil controller
1 analog output 0..10V (fan speed)
2 relay outputs 5A (valve)
1 binary/analog input
2 temperature sensor inputs

building

Wiring diagram



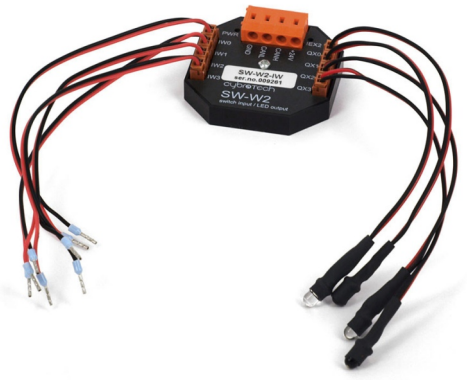
Technical specifications

Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023)
Output type	0..10V 10mA (7 bit, 0..100%) relay 5A/250VAC resistive
External temperature sensor	ES-P, ES-B or ES-W
Cable length	10m
Power supply	24V (18..28V), 100mA (25mA+15mA*number of active outputs)
Galvanic isolation	4kV between internal circuit and relay contacts
Degree of protection	IP20
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Mounting	inside the fan coil unit
Dimensions	108x86x46mm
Weight	200g
Standards	EN 60730-1

SW-W3

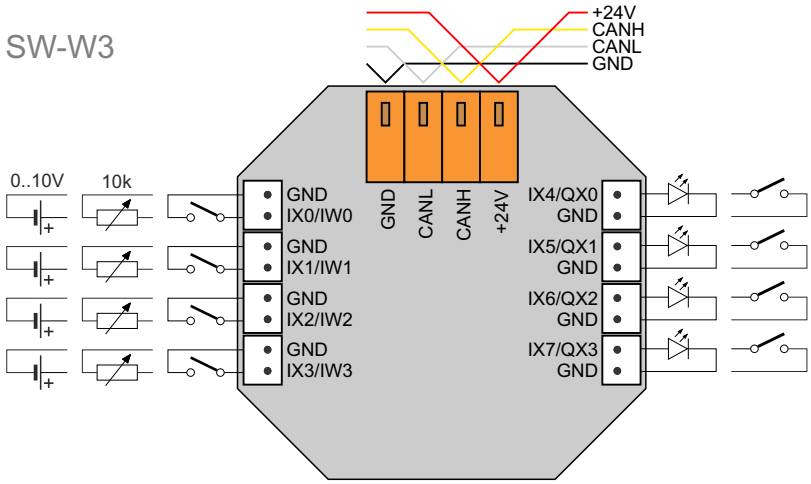
IEX-2 module
4 switch or potentiometer inputs
4 LED outputs or switch inputs
2 temperature sensor inputs (TIR only)
1 IR receiver input (TIR only)

building

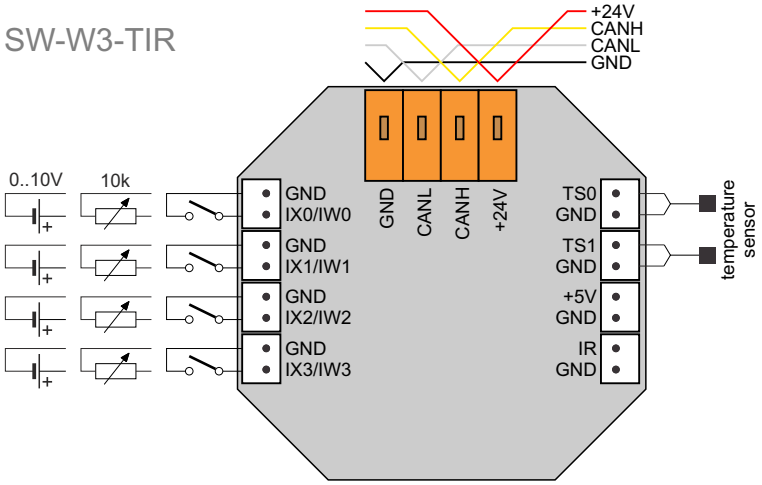


Wiring diagram

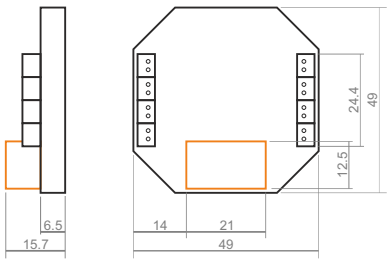
SW-W3



SW-W3-TIR



Dimensions



Technical specifications

Input type	dry contact, internal pull-up 12V 2mA 0..10V (10 bit, 0..1023) or potentiometer
LED output	5V 10mA
External temperature sensor	ES-P, ES-B or ES-W
Cable length	10m
Power supply	24V (18..28V), 70mA (30mA+10mA*number of active LEDs)
Galvanic isolation	none
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Mounting	in-wall, flush box fi60
Dimensions	50x50x15mm
Weight	40g
Standards	EN 60730-1

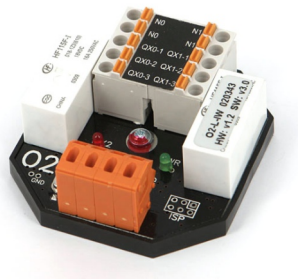
Order code

SW-W3	basic version
SW-W3-TIR	temperature and IR sensor inputs

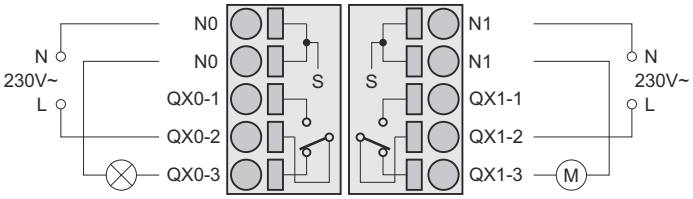
O2

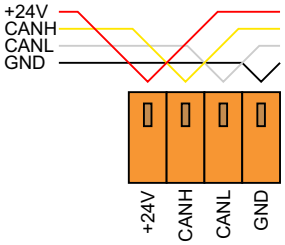
IEX-2 module
2 relay outputs 16A
2 mains sense inputs

building



Wiring diagram





Mains sense is connected
to the relay middle contact

Order code

O2-L	power relay for lights and blinds normally open and normally closed contacts

Technical specifications

Output type	relay 16A/250VAC resistive
Power supply	24V (18..28V), 60mA
Galvanic isolation	5kV between internal circuit and relay contacts
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Mounting	in-wall, flush box fi80
Dimensions	55x60x20mm
Weight	80g
Standards	EN 60730-1

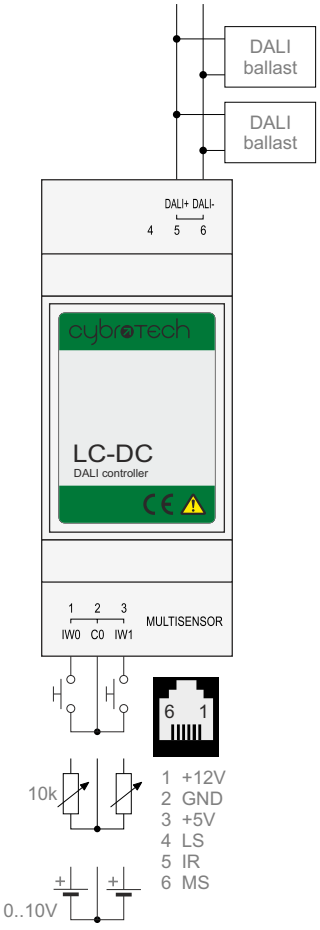
LC-DC

IEX-2 module, DALI light controller
DALI command send and receive
DALI power supply
2 analog/digital inputs
light, motion and IR sensor input

building

EXAMPLE
CyPro/Examples/
DaliDemo.cyp

Wiring diagram



LRI8134 multisensor

Pin	LC-DC	multisensor
1	+12V output	+12V power supply
2	GND	GND
3	+5V output	+5V power supply
4	LS input 0..10V	light sensor
5	IR input	IR receiver
6	MS input	motion sensor

Technical specifications

Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023) potentiometer 0..10k (10 bit, 0..1023)
Sensor input	LRI8134 (multisensor)
DALI output current	200mA
Load protection	short circuit protected
Number of ballasts	64
Power supply	24V (18..28V), 120mA
Galvanic isolation	none (DALI ballasts must be SELV)
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	120g
Standards	EN 60730-1

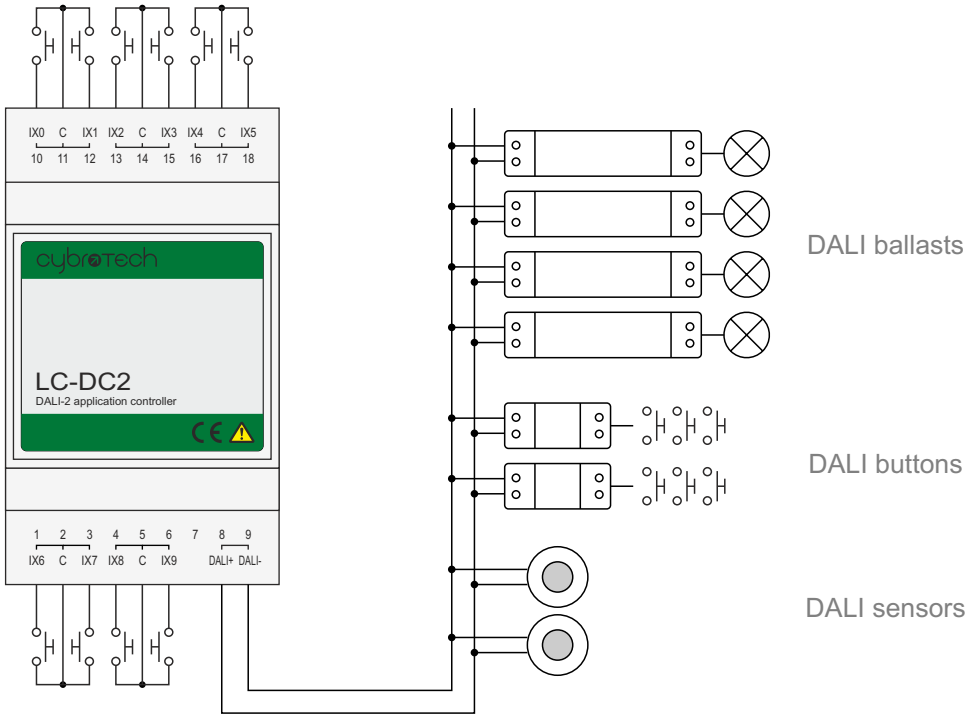
LC-DC2

IEX-2 module
DALI-2 application controller
multi-master, send and receive
8, 16 and 24 bit frames
DALI power supply
galvanic isolation (option)
10 digital inputs

building

EXAMPLE
CyPro/Examples/
DaliDemo.cyp
DaliDemo DT8.cyp

Wiring diagram



Technical specifications

LC-DC2

DALI output current	100mA
Ballasts per device	32 (2mA per device)
Bus length	200m
Galvanic isolation	no
230V tolerance	no
Recommended usage	smart home

LC-DC2-ISO

DALI output current	200mA
Ballasts per device	64 (2mA per device)
Bus length	300m
Galvanic isolation	3kV, DALI to digital ground
Surge protection	4kW (8/20us), 30kV/150pF
230V tolerance	no
Recommended usage	office buildings and large halls

Duty cycle	1:10 (DALI active 10% of the time)
Input type	dry contact, internal pull-up 12V 2mA
Power supply	24V (18..28V), 200mA
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Degree of protection	IP20
Dimensions	53x107x58mm
Weight	120g
Standards	EN 60730-1, EN 61000-4-4

Order code

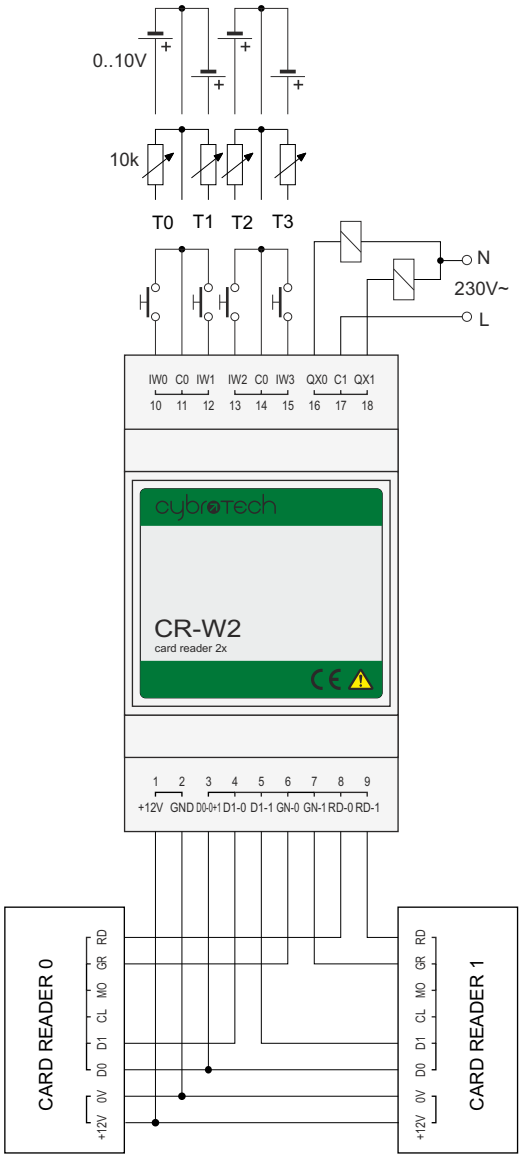
LC-DC2	DALI-2 controller
LC-DC2-ISO	DALI-2 controller with galvanic isolation

CR-W2

IEX-2 module
2 Wiegand interface
4 analog/digital inputs
2 relay outputs 5A

building

Wiring diagram



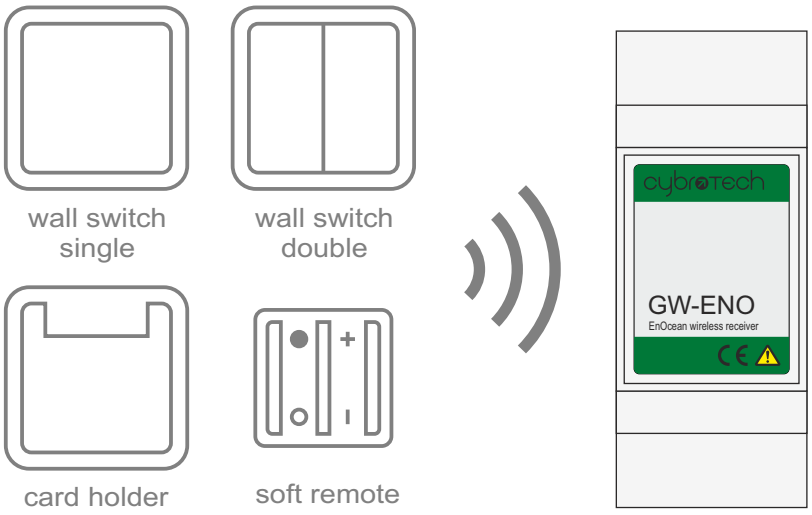
Technical specifications

Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V or potentiometer 10k
Output type	relay 5A/250VAC resistive
Reader protocol	Wiegand
Data input	active low, internal pull-up 5V 1mA
Data timing	20us min. pulse on D0/D1, 20ms timeout
Data format	26/34/44 bits processed, 1..64 bits raw
Power supply output	12V 500mA
LED output	500mA NPN open collector, GN/RD
LED connection	output to +12V or +24V
Power supply	24V (18..28V), 40..350mA (idle to full load)
Galvanic isolation	none
Operating conditions	0..45°C, 0..95% rh non-condensing
Storage temperature	-20..75°C
Degree of protection	IP20
Dimensions	53x107x58mm
Weight	160g
Standards	EN 60730-1

GW-ENO

IEX-2 EnOcean receiver for switches

building



SUPPORTED MODULES	MODEL	PROFILE	eno_command
Wall switch, single or double	CWS-2-1-01	F6-02-01	unique button code
Soft remote	CRC-2-6-0x	F6-02-02	unique button code
Card holder	CCS-2-1-01	F6-04-01	unique button code

Technical specifications

Interface	EnOcean wireless protocol
Frequency	868 MHz
Coverage	10m indoor, 100m outdoor
Number of modules	unlimited (no learning)
Power supply	24V (18..28V), 40mA
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	100g
Level of ambient pollution	2
Standards	EN 60730-1

EnOcean

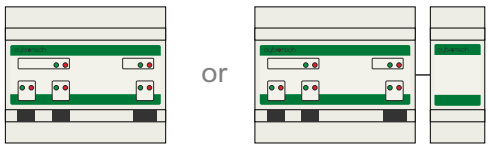
EnOcean Gateway, bidirectional

building

EXAMPLE

CyPro/Examples/
EnOceanGateway

Hardware options



Cybro-3-ENO or Cybro-3 GW-ENO2

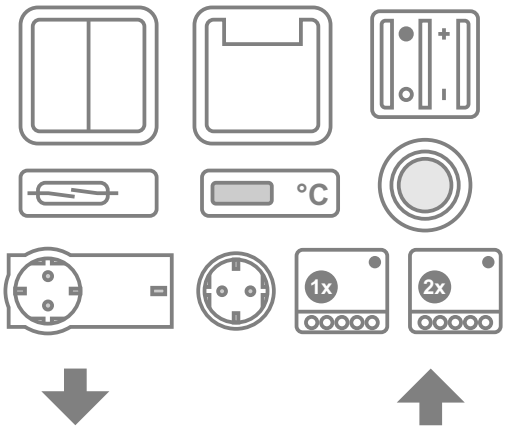
Both options have the same functionality and specifications. Not compatible with Cybro-2.

Software

EnOceanGateway.cyp

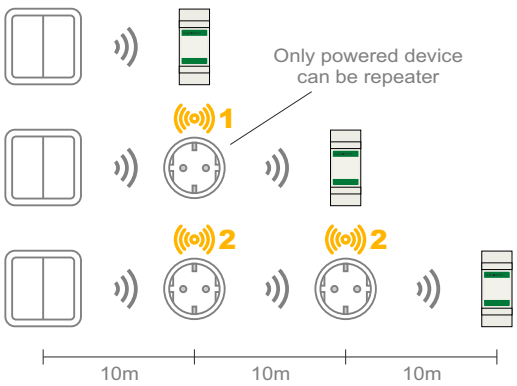
Mini scada

Gateway is written as plc program. To use with your application, just copy code and variables.



SUPPORTED MODULES	MODEL	PROFILE	eno_iw00[n]	eno_iw01[n]	eno_iw02[n]	eno_qw00[n]	eno_qw01[n]
Wall switch, single or double	CWS-2-1-01	F6-02-01	input 0/1/2/4/8	-	-	-	-
Soft remote	CRC-2-6-0x	F6-02-02	input 0/1/2/4/8	-	-	-	-
Soft button	TSB-2-2-01	D2-03-0A	action 1/2/3/4	-	battery [%]	-	-
Card holder	CCS-2-1-01	F6-04-01	input 0/1	-	-	-	-
Door sensor	SDO-2-1-05	D5-00-01	input 0/1	-	-	-	-
Motion sensor	PIR-2-1-01	A5-07-03	input 0/1	lightness [lux]	battery [0.1V]	-	-
Temperature sensor	STP-2-1-05	A5-02-05	temp [0.1°C]	-	-	-	-
Temperature and humidity	STPH-2-1-05	A5-04-01	temp [0.1°C]	humidity [%]	-	-	-
Smart plug	ASP-2-1-10	D2-01-0A	-	-	-	output 0/1	-
Smart plug with metering	ASP-2-1-11	D2-01-0B	power [W]	energy [Wh]	-	output 0/1	-
Micro smart plug with metering	MSP-2-1-11	D2-01-0E	power [W]	energy [Wh]	-	output 0/1	-
Relay switch one channel	SIN-2-1-01	D2-01-0F	-	-	-	output 0/1	-
Relay switch two channels	SIN-2-2-01	D2-01-12	-	-	-	output 0/1	output 0/1
Radiator valve	MVA004	A5-20-01	temp [0.1°C]	position [%]	status bits DB2	setpoint %/°C	oper. mode DB1

Repeater level



EnOcean specifications

Interface	EnOcean wireless protocol
Frequency	868 MHz
Coverage	10m indoor, 100m outdoor
Number of modules	20

Technical specifications

Power supply	24V (18..28V), 40mA
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	100g
Level of ambient pollution	2
Standards	EN 60730-1

GSM-1

IEX-2 module
send/receive SMS
make and receive a call
GPRS data connection
4 analog/digital input
2 relay output 1A

industrial building

activate output with a call

activate output with a message

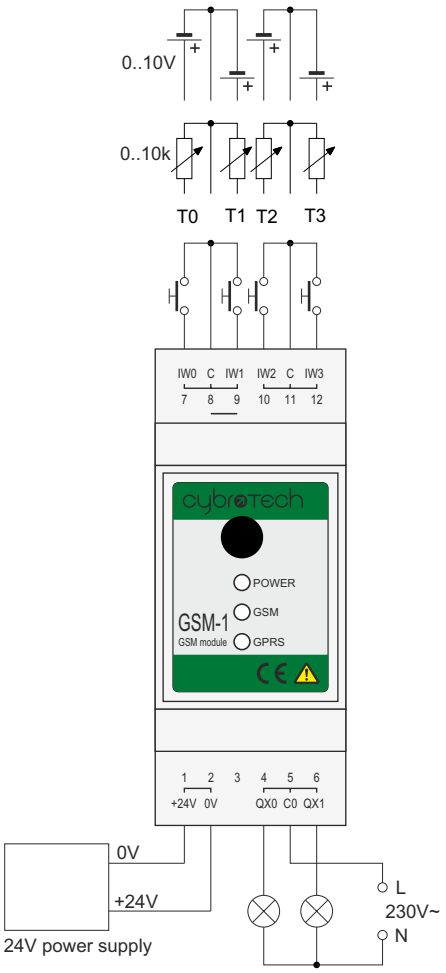
make a call when condition is met

send message when condition is met

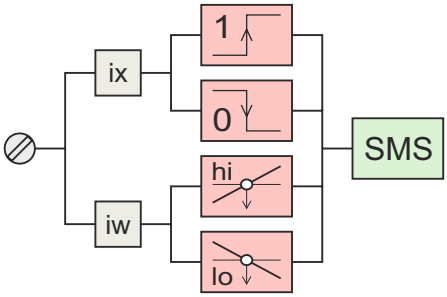
read measurements with a message

authorize other users with a message

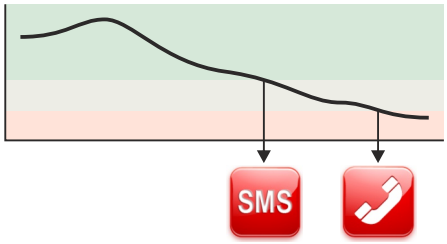
Wiring diagram



Trigger events



Example



Technical specifications

Input type	dry contact, internal pull-up 12V 2mA analog input 0..10V (10 bit, 0..1023)
Output type	relay 1A/250VAC resistive, normally open
Quad band	GSM/GPRS 850/900/1800/1900 MHz
Performance	class 4 (2W) 850/900MHz, class 1 (1W) 800/1900MHz
Antenna	internal or external (SMA 50 ohm)
Power supply	24V (18..28V), 70mA (standby), 100mA (active)
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	160g
Level of ambient pollution	2
Standards	EN 301489-1, EN 301489-7, EN 301511, EN 61010-1, EN 61010-2-201, EN 61131-2

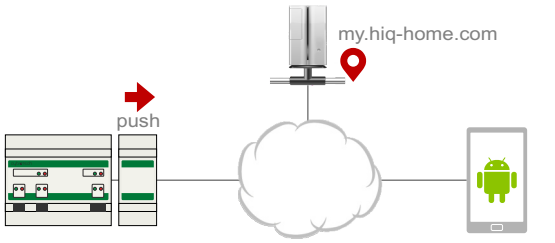
GSM-2

IEX-2 module
data connection for Cybro
send and receive SMS message
make and receive a call

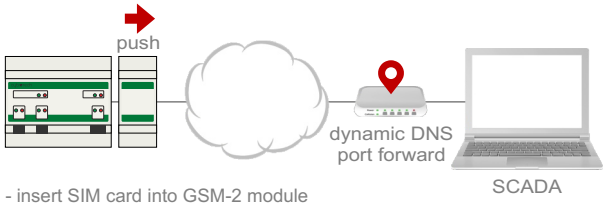
industrial building

EXAMPLE
GsmDataDemo.cyp
GsmSmsDemo.cyp
GsmCallDemo.cyp

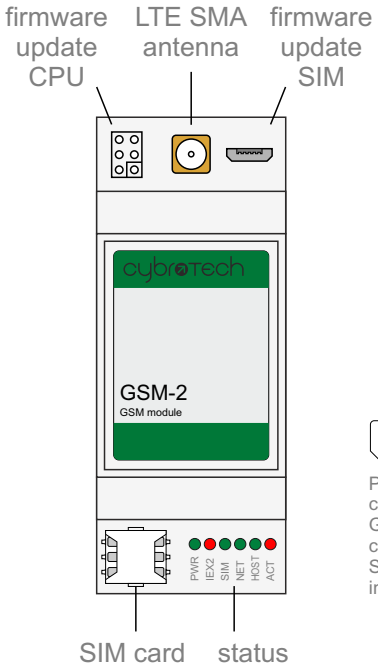
Data



- insert SIM card
- configure push to my.hiq-home.com
- mark your variables as visible in scada
- install app and autodetect configuration
- enable internet access



- insert SIM card into GSM-2 module
- subscribe to dynamic DNS service, choose a hostname
- configure router to update IP address at the DNS provider
- configure controller push to choosen hostname, port 8442
- assign static IP address to your PC
- forward router UDP port 8442 to your PC, port 8442
- open CybroRelay, CybroOpcServer and SCADA



SIM

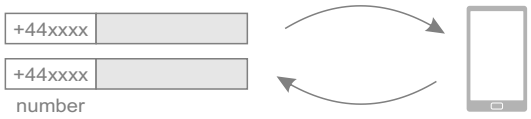
Place the SIM card on the pcb, contacts down, notch bottom left. Gently push to the left, so that the card slides into the connector. If SIM card has an active PIN, put it into the phone and disable it.

- PWR power supply
- IEX bus activity
- SIM card ready
- NET cellular network
- HOST connected to server
- ACT data, SMS or call activity

SMS

The SMS interface allows controller to send and receive messages. It acts like a serial port: controller create and send the message, and receive and parse the content. Message can be sent periodically, on event, or by request. For example, program can send process information and alarm messages. By sending a message, user may control outputs or set program parameters. Message format is defined by user, all processing is done by the PLC program. Also for the access rights, it is up to PLC program to decide who is allowed to send and receive messages.

Call



Call interface allows controller to make and receive a call. It acts like a serial port: to make a call, write phone number and send. To receive a call, check receive status. Caller number appears in the receive buffer, controller can accept or decline the call. Call may be used to alert the user, or to trigger an action, such as sending a report. All processing is done by the PLC program.

Technical specifications

Cellular technology	LTE-M and NB-IoT (2G/4G/5G)
Communication mode	Cat-M/Cat-NB/GPRS/EDGE
RF power class	class 5 (125mW)
SIM holder	nano SIM (12.3x8.8mm, 1.8V)
Antenna	LTE SMA multiband 50ohm (supplied)
CPU firmware update	ST-LINK/V2 2x3pin 2.54mm header
SIM firmware update	SIM7070G, USB micro-B
Power supply	24V (18..28V), 50mA (standby), 100mA (active)
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	65g
Level of ambient pollution	2
Standards	EN 60950-1, EN 62311, EN 301 489-1, EN 301 489-19, EN 301 489-52, EN 301 908-1, EN 301 908-13, EN 301 511, EN 303 413

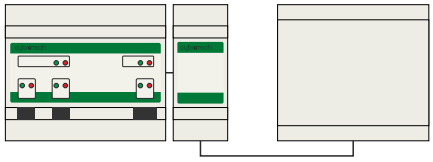
COM module

IEX-2 protocol converter
RS-232 / RS-485
galvanically isolated

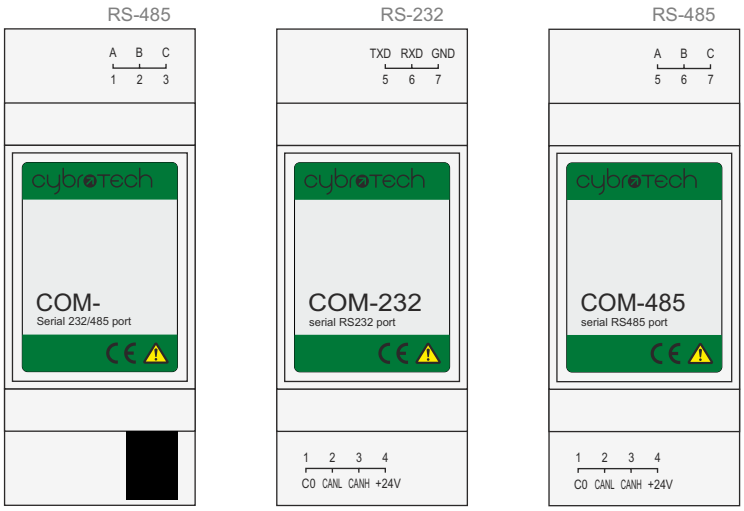
industrial building

EXAMPLE

Serial port w COM-PGM.cyp
ModbusRtuMaster w COM-MB.cyp



Cybro COM serial device



IEX-2	RJ9 x2	terminals	terminals
RS-232	RJ9 x1	terminals	none
RS-485	terminals	none	terminals

Order code

COM-	IEX-2 to RS-232/485
COM-232-	IEX-2 to RS-232
COM-485-	IEX-2 to RS-485
-PGM	Free-programmable port
-MB	Modbus RTU master
-DMX	DMX512 controller for lights and effects
-WXT	Vaisala WXT520 weather station
-PMI	Eastron/Iskra/Circutor power meter
-SAT	Satcon PV inverter
-SAN	Sanrex PV central inverter
-KAC	Kaco Powador PV inverter
-BON	Bonfiglioli PV inverter

Example

COM-485-WXT	Vaisala WXT520 weather station connected with RS485

COM module connects an external device to the controller. Communication protocol is implemented within the module itself, so controller sees the external device as native IEX module.

For example, to connect Eastron SDM120 power meter, use COM-485 module with PMI firmware. With this combination, meter is visible as pm00_real_power, pm00_reactive_power, pm00_total_energy and so on. Variables are immediately available in your program.

COM module is available in three hardware versions, with a different set of connectors and terminals. All three are internally equal, each firmware is compatible with any of them.

For a serial device not listed here, request a quote.

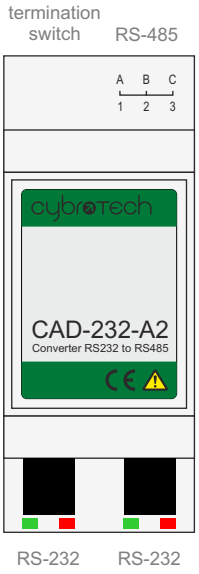
Technical specifications

Power supply	24V (18..28V), 40mA
Galvanic isolation	1kV between internal circuit and com port
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	120g
Level of ambient pollution	2
Standards	EN 61010-1, EN 61010-2-201, EN 61131-2

CAD-232-A2

RS-232 to RS-485 converter

industrial building

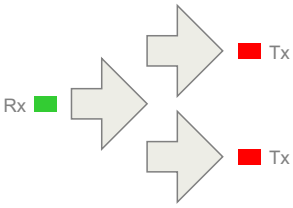


Rx LED
Tx LED

RJ9

1 - TxD
2 - RxD
4 - GND

Signal path



A message received on one channel is simultaneously transmitted on the other two channels.

Technical specifications

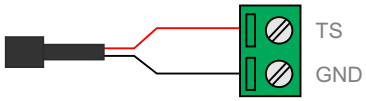
Baud rate	19200 (4800..38400)
Galvanic isolation	1.5kV, 24V/232 to 485
RS485 termination	120 Ohm, 1V offset
RS485 transmit enable	automatic
Power supply	24V (18..28V), 50mA
Operating conditions	0..50°C, 0..85% rh non-condensing
Mounting	DIN rail (35mm)
Degree of protection	IP20
Dimensions	36x107x58mm
Weight	80g
Level of ambient pollution	2
Standards	EN 60730-1

ES

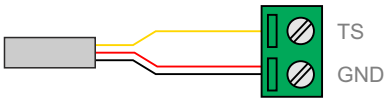
Temperature sensor

building

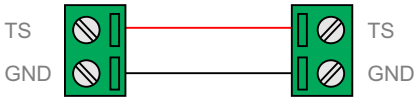
ES-P



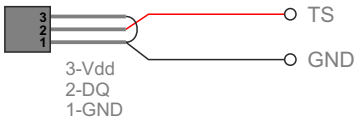
ES-B



ES-W



DS18B20 wiring diagram



Technical specifications

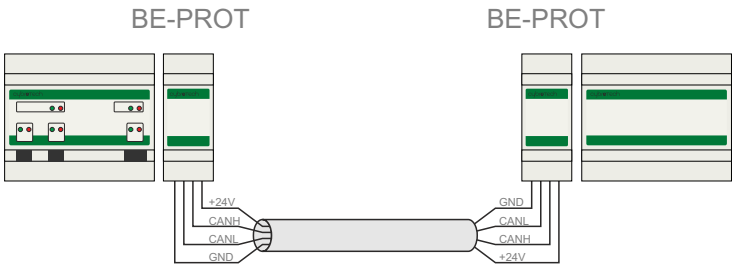
ES-P	
Housing	heatshrink tube
Operating range	-50 to +100°C
Degree of protection	IP50
Cable length	2m
ES-B	
Housing	steel tube
Operating range	-50 to +100°C
Degree of protection	IP67
Cable length	5m
ES-W	
Housing	plastic box, white
Operating range	0 to +50°C
Degree of protection	IP20
Mounting	wall surface
Dimensions	71x71x27mm
Sensor type	DS18B20 digital thermometer
Accuracy	±0.2°C typ. (-10 to +85°C) ±0.5°C max. (-10 to +85°C) ±2.0°C max. (-50 to +100°C)
Recommended cable	UTP 0.25..0.5mm2

Order code

ES-P	heatshrink
ES-B	steel tube
ES-W	plastic box

Accessories

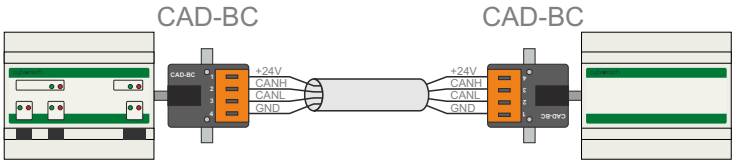
industrial building

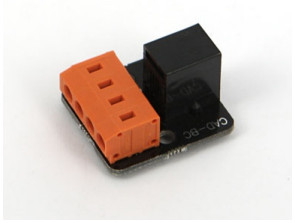


BE-PROT

IEX-2 surge protector, RJ9 to terminals

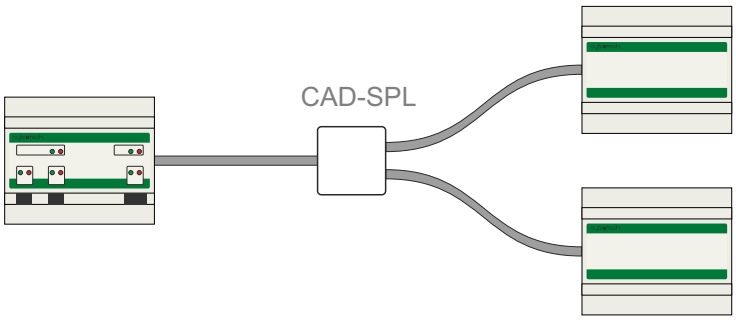
Surge protection	1.5kW at 10/1000us
Error output	24V 10mA opto isolated





CAD-BC

IEX-2 bus expander, RJ9 to terminals



CAD-SPL

IEX-2 bus splitter, 1xRJ9 into 2xRJ9

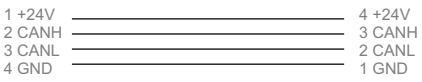
Cables

IEX-2 cable

CAD-Px

IEX-2 cable, RJ9 to RJ9

CAD-P0	3cm
CAD-P1	1m
CAD-P2	2m
CAD-P3	3m

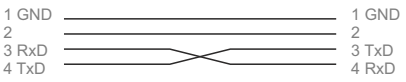


RS232 cable

CAD-232-Px

RS-232 cable, RJ9 to RJ9, Cybro to CAD-232-A2

CAD-232-P0	20cm
CAD-232-P2	2m

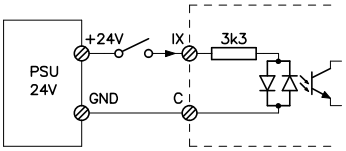


I/O schematics

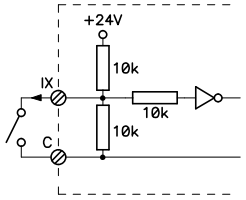
internal input/output wiring diagrams

Digital input

opto isolated

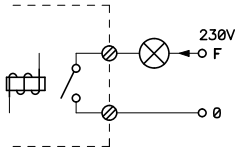


dry contact

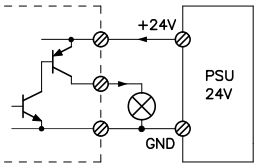


Digital output

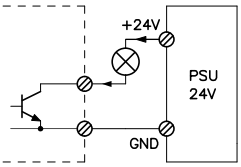
relay



PNP transistor

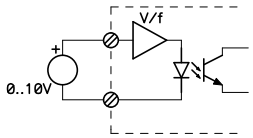


NPN transistor

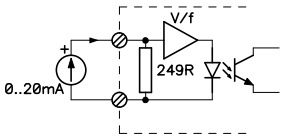


Analog input

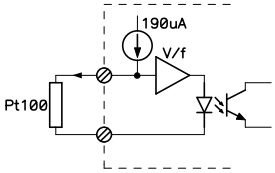
voltage



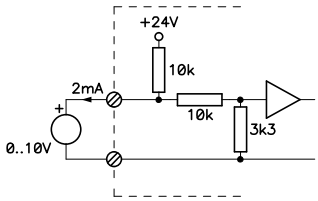
current



resistance

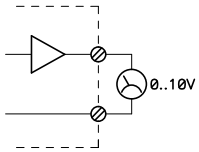


analog/digital

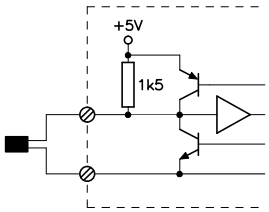


Analog output

voltage



Temperature sensor



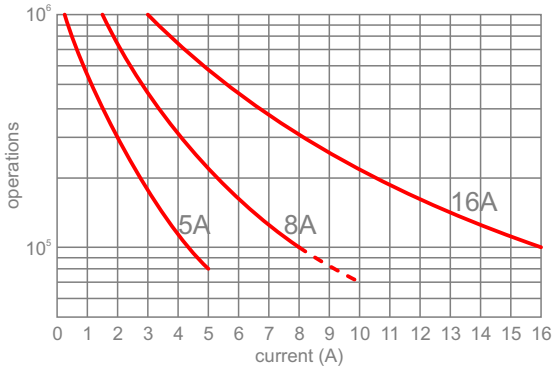
Load limits

Nominal relay current is given for a resistive AC load. Real-life devices come with all sorts of trouble: transients, capacitive or inductive load, and non-linear voltage/current relation. To ensure the optimal service life, output current must be derated. Derating depends on load type, AC or DC voltage and required number of operations. Ignoring the guidelines may result in premature wear, contact sticking, overheating or destruction. Minimum recommended current is 100mA, otherwise oxidation layer buildup may rise contact resistance.

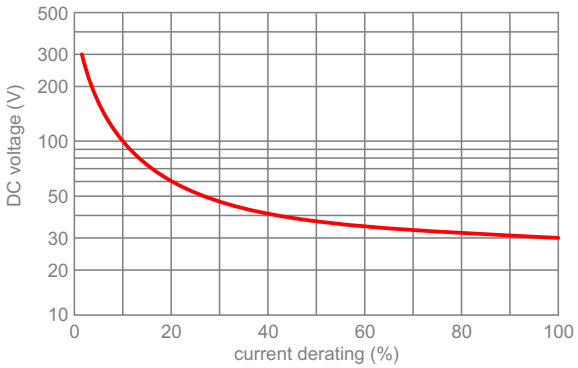
Relay contact	16A NO	16A NC	8A	5A
LED LAMP				
Compact E14/E27/GU10	700W	400W	400W	N/A
Stripe or panel with electronic transformer	700W	400W	400W	N/A
INCADESCENT LAMP				
Incadescent / halogen 230V	1800W	1000W	800W	300W
Halogen 12/24V with electronic transformer	700W	400W	400W	N/A
FLUORESCENT LAMP				
Compact fluorescent E14/E27	700W	400W	400W	100W
With electronic ballast	700W	400W	400W	100W
With parallel compensation	500W/80uF	300W/50uF	250W/30uF	N/A
Duo (lead-lag) connection	1800W	1000W	1000W	300W
GAS DISCHARGE LAMP				
Mercury/sodium-vapor without compensation	700W	400W	400W	150W
Mercury/sodium-vapor with parallel compensation	400W/50uF	250W/30uF	250W/30uF	N/A
Metal-halide (HID) without compensation	700W	400W	400W	150W
Metal-halide (HID) with parallel compensation	400W/50uF	250W/30uF	250W/30uF	N/A
ELECTRIC MOTOR				
single-phase asynchronous motor	1200W	600W	600W	N/A
brushed DC electric motor	1000W	500W	500W	N/A

With the rated load, expected contact life is 20,000 cycles. With 50% load, expectancy goes to 100,000 cycles.

Contact life vs. current (resistive load)



DC breaking capability



Transient burst

Caused by: load capacitance
Overload ratio: 100..1000x
Typical duration: 10..100us
Solution: RC network, derating

Surge current

Caused by: non-linear load
Overload ratio: 5..10x
Typical duration: 10..20ms
Solution: derating

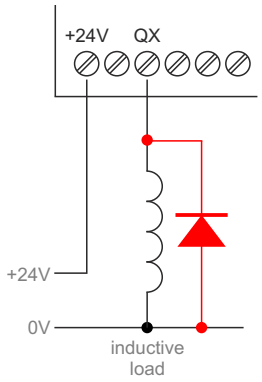
Break sparking

Caused by: load inductance
Overvoltage: 100..1000V
Typical duration: 5..20us
Solution: surge protector, derating

Surge suppress

24V transistor outputs has internel protective diodes suitable for most applications. However, when large inductive load is connected, it is recommended to add external suppression diode, 1N4007 or equivalent.

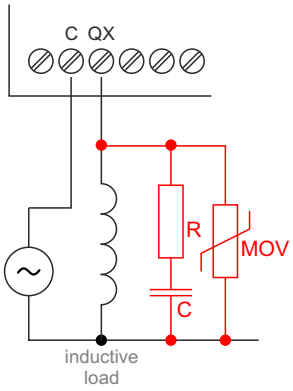
Suppression diode may also be added to extend life of DC loaded relay contacts.

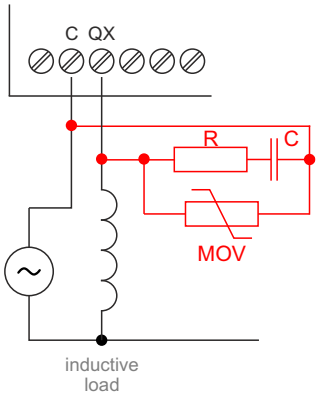


For large AC loads use resistor/capacitor suppressors across either the load or the relay contact.

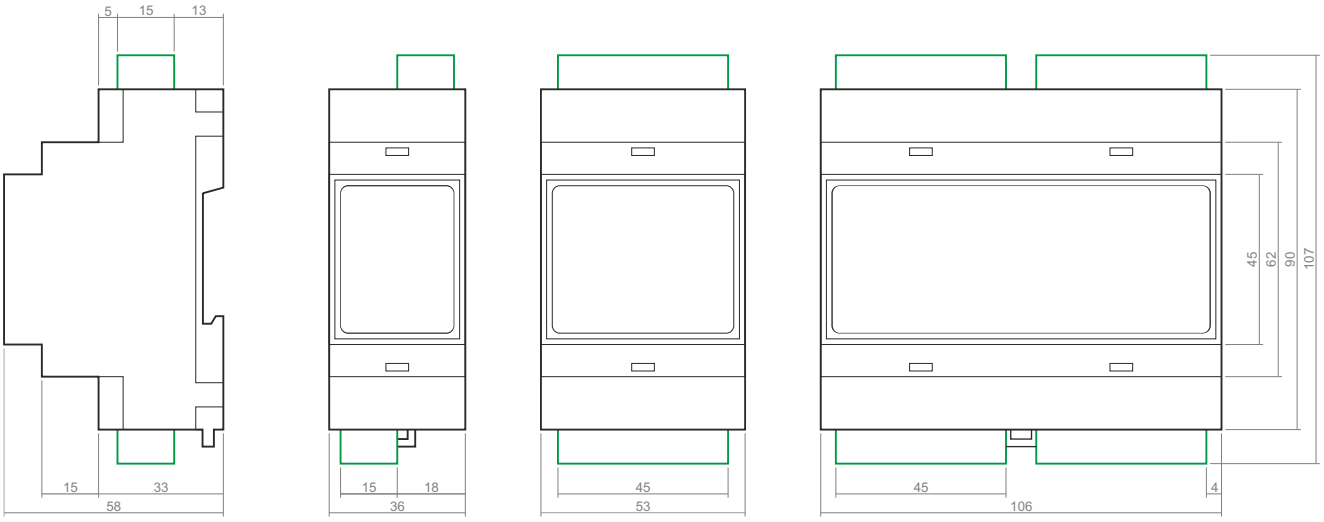
R > 0.5 x Vrms [Ohm]
C = 2 to 4 nF for each 10VA of load

You can also add metal oxide varistor (MOV) to limit the peak voltage. MOV rated voltage should be at least 20% higher than the nominal operating voltage.

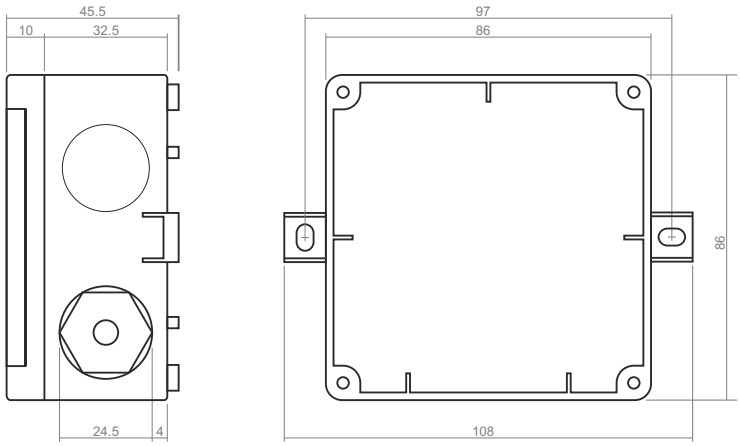


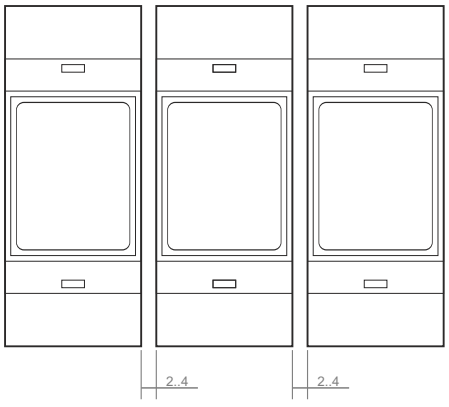


Dimensions



2M 3M 6M





Spacing on DIN rail:
min 2mm (pushed)
max 4mm (pulled)

Revision history

2000-02, CyBro.P, CyBro.B, CyBro.C

2002-10, Integra-BM v8
- RC, OP, TS, FC, LC

2005-12, CyBro-2 v10
- AiR-12, AiV-12, AiC-12, AoV-12
- Bio-24R, OP-2

2006-03, Integra-BM v15
- OP-3, LC-S, LC-D, MS, SW, HR

2011-04, Integra-BM v16
- CAD-UTP cable
- TS-H, ES-A, SW-L

2017-03, Cybro Hardware Manual v1.0
- industry and building products integrated

2018-04, Cybro Hardware Manual v3.0
- Cybro-3 added

2018-05, Cybro Hardware Manual v3.2
- OP-3 removed

2018-06, Cybro Hardware Manual v3.3
- Cybro-3H, Cybro-Pi0, Cybro-Pi3

2019-02, Cybro Hardware Manual v3.5
- EnOcean, GW-ENO2

2019-06, Cybro Hardware Manual v3.6
- supply and grounding recommendations

2019-07, Cybro Hardware Manual v3.7
- Cybro-Pi0 removed
- relay specifications updated

2019-10, Cybro Hardware Manual v3.9
- RJ pin numbering corrected
- wiring diagrams added

2020-06, Cybro Hardware Manual v3.15
- Cybro-Pi4 added

2020-08, Cybro Hardware Manual v3.16
- Cybro-3W added
- Universal I/O mapping table

2020-10, Cybro Hardware Manual v3.17
- Cybro-3H and Cybro-3W new order codes
- Cybro-3W specifications revised
- CR-W2 specifications revised

2021-01, Cybro Hardware Manual v3.18
- LC-DC2 added

2022-04, Cybro Hardware Manual v3.20
- Cybro-3 order code, RFM option added
- Cybro-3 order code, ENO option removed
- Cybro-3H/3W, COM3 port added
- Cybro-2 and Cybro-Pi3 removed

2022-09, Cybro Hardware Manual v3.21
- Cybro-3 order code, ENO option restored

2023-03, Cybro Hardware Manual v3.23
- RFM description page added
- OP-5, RE-2 and ZigBee Gateway removed
- cable length for temperature sensor revised

2023-04, Cybro Hardware Manual v3.24
- Internet connetion options added

2024-04. Cybro Hardware Manual v3.25
- LC-D and LC-S removed
- LC-DC2 specifications revised
- GW-MP, RC-A and COM-CAN removed
- GSM-2 added