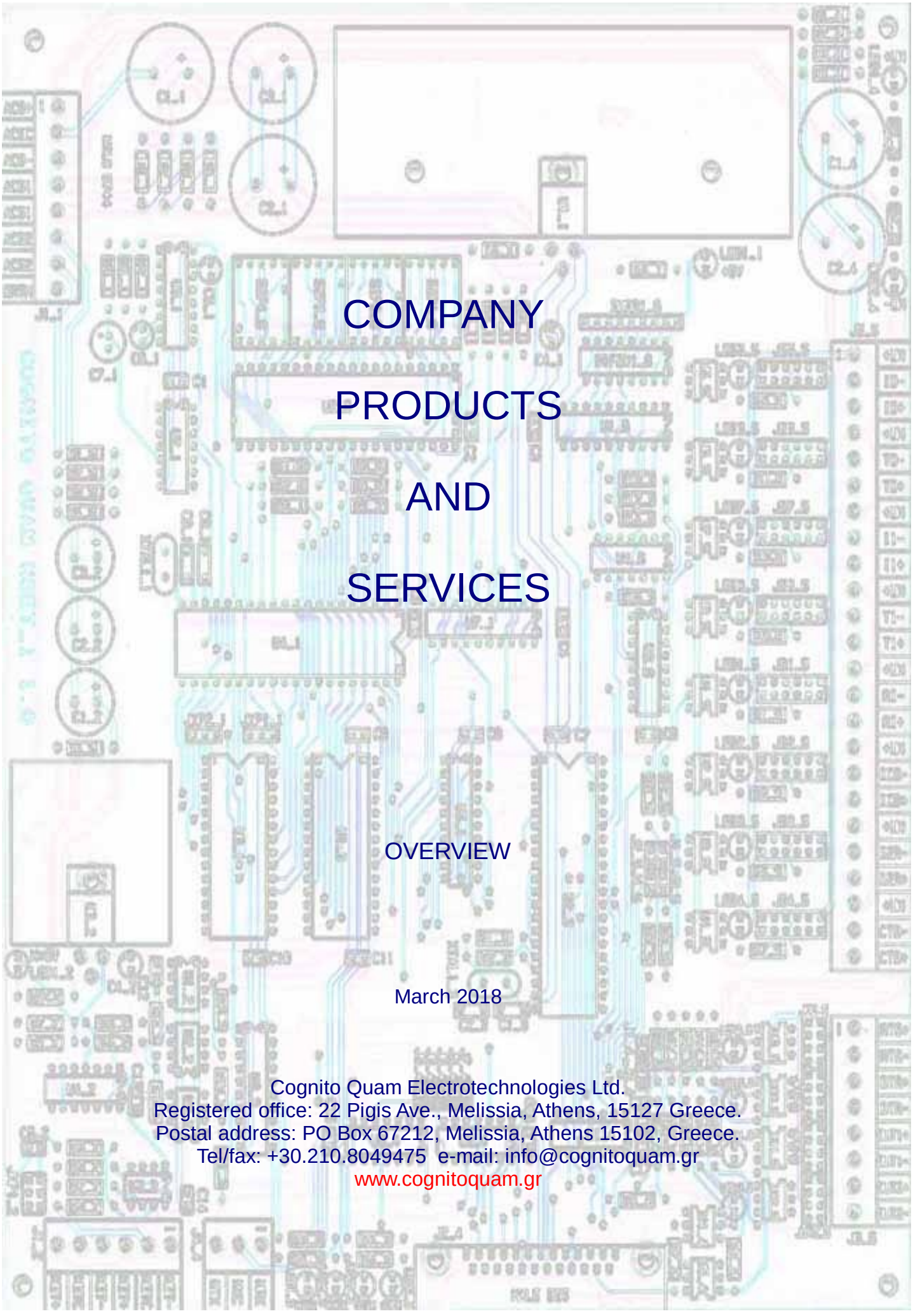

COMPANY

PRODUCTS

AND

SERVICES

OVERVIEW

March 2018

Cognito Quam Electrotechnologies Ltd.
Registered office: 22 Pigis Ave., Melissia, Athens, 15127 Greece.
Postal address: PO Box 67212, Melissia, Athens 15102, Greece.
Tel/fax: +30.210.8049475 e-mail: info@cognitoquam.gr
www.cognitoquam.gr

INTRODUCTION

Automation on the factory floor calls for a wide range of expertise and talent.

Within the given the management procedures and production processes taking place, energy is consumed at various powers under “local” and “global” control based on timely measurements.

Thus in our effort to address the needs of the factory floor in a systematic and complete manner, we have identified and are cultivating the following four areas of expertise:

- Production data management involving the distribution and collection of controlling commands and messages. This is based on our network communications know-how (in the form of our own “Quamatic” platform (p. 91) and interfaces to other similar networks) which allows for the “top-down” design of the system architecture and its “behaviour” at all levels,
- Control and robotics which facilitate and realize this required behaviour,
- Test and measurement technologies which ensure the timely and effective control of the monitored processes, and
- Power electronics to control the flow of energy in the floor plant.

We believe that in today’s globally competitive environment a company’s products and services should add value to its customer’s products and services and be instrumental in their success.

As such, all our products are characterized by unique features which give extra value to our customers. When maximizing value we must also address specific needs and so our technologies are also available for OEM use.

Finally, our research and development services are available in integrating our technologies in industrial systems or individual products as well as in the design of new and challenging devices and equipment.

This document offers an overview of our capabilities in the brave new and old world of industrial automation.

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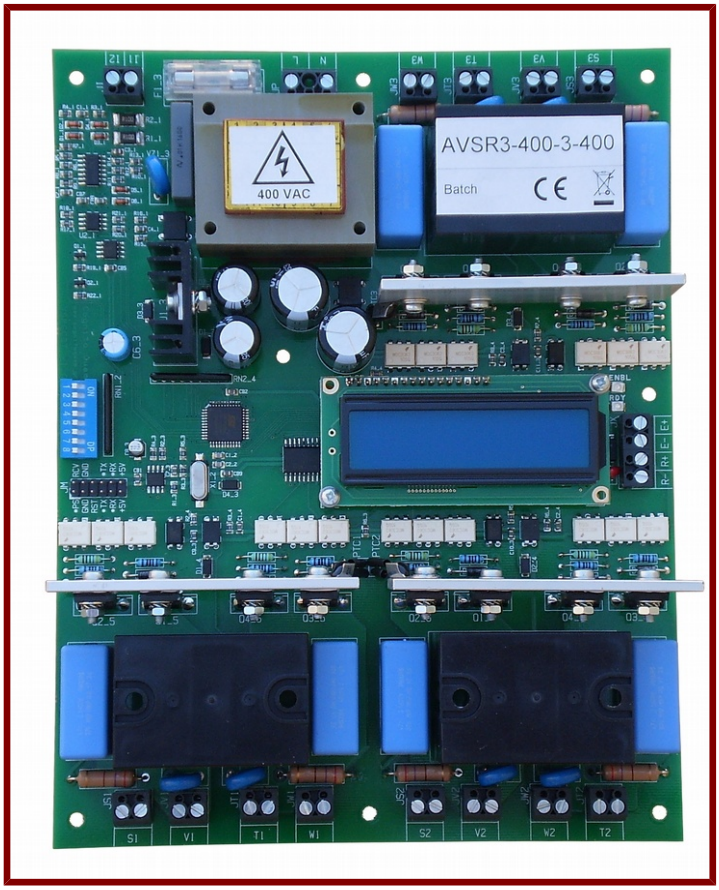
1. POWER FACTOR CONTROL PRODUCTS

1.a. AVSR3 Triple Switch Autocalibrating Variable Step Regulator

The AVSR3 employs our variable step technology to compensate reactive current in seven steps. It features three 25 A solid state switches to connect three compensating capacitor banks in and out of the single- or three- phase line system. At installation no adjustments are required as each capacitor size is detected automatically making AVSR3 commissioning purely “wire-up-and-play”.



AVSR3 autocalibrating power factor regulator

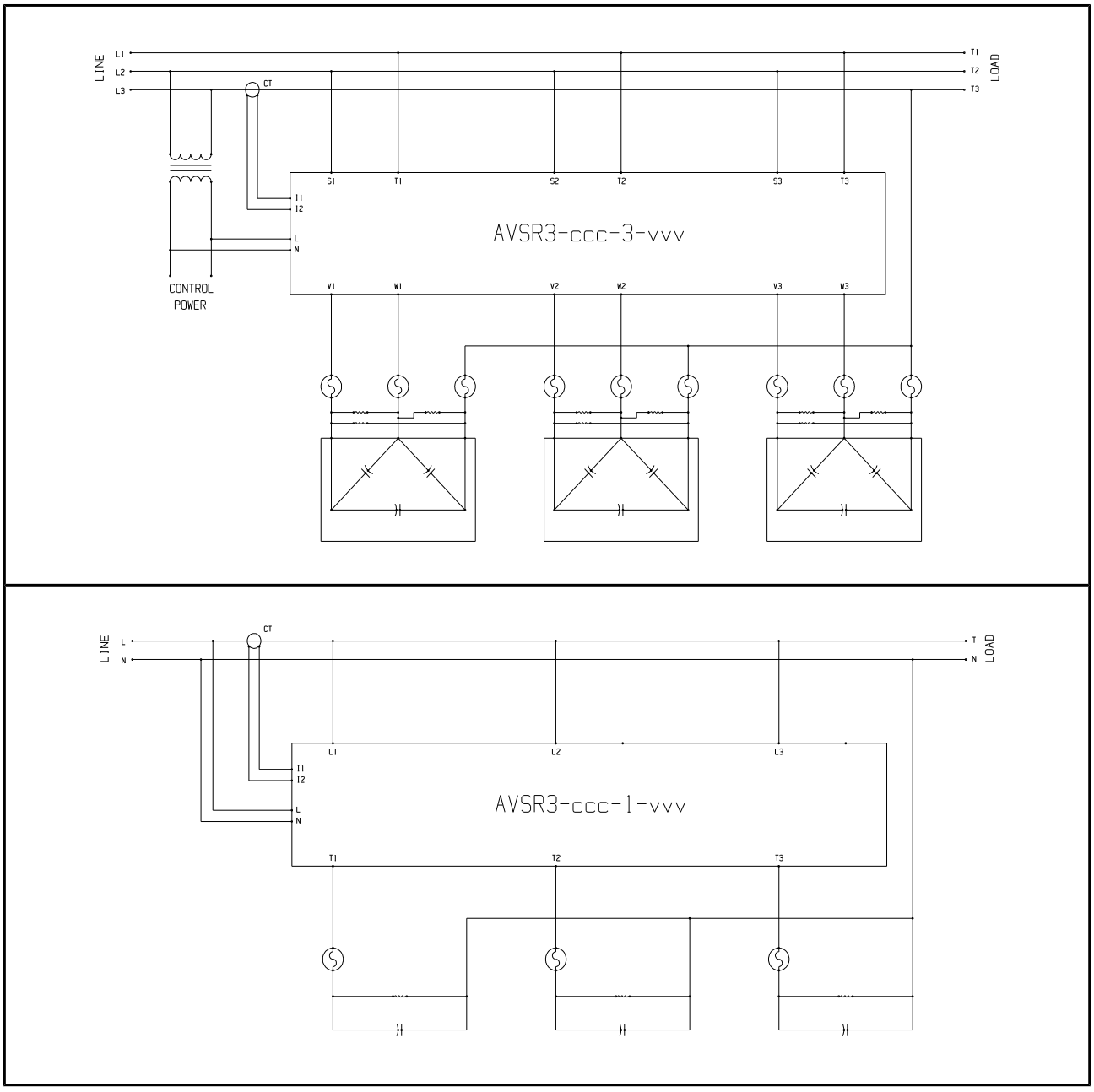
The variable step technology provides for different capacitor banks of any size to correct power factor in practically any arbitary minimum step and correction range size. At every sampling instant, the controller calculates the required compensation step and connects or disconnects a combination of banks whose sum is equal or closest to the calculated step value. In the AVSR3, three banks are used and, if sized as x1, x2 and x4 multiples of the smallest required step, provide seven steps of compensating operation. Switch activation/deactivation happens at every sampling instant as set at the DIP switch between 5 and 30 seconds making the AVSR3 particularly suitable for dynamic power factor (PF) compensation of frequently-started, low-duty or variable loads such as lifts, conveyors, compressors, pumps and office lighting.

Each capacitor bank size is autodetected during AVSR3 installation. The unit features an autocalibrating function during which the AVSR3 corrects all internal errors and offsets, measures the current transformer phase shift and the individual capacitor bank sizes. The measured parameters are then used during normal operation ensuring accurate, effective and dependable performance. Following autocalibration no other adjustment is required making AVSR3 installation quick and error-free.

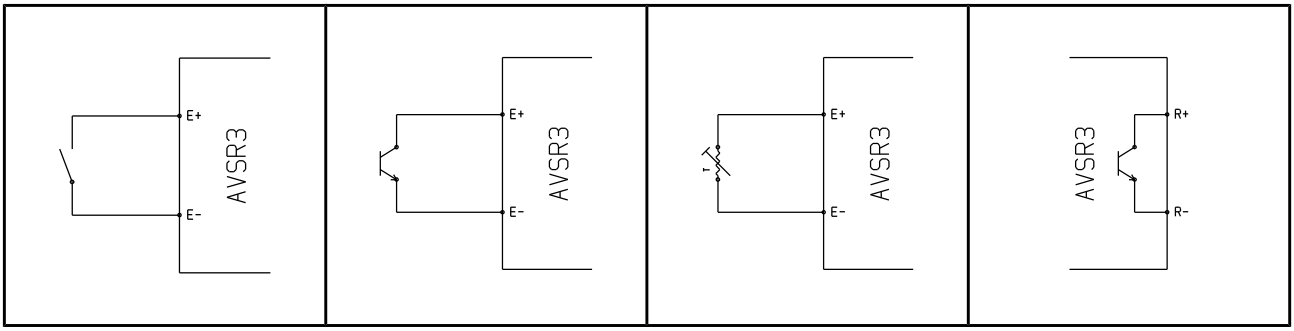
AVSR3 Feature Summary	
Variable compensating capacitance step	Variable compensating capacitance step is any combination of the three driven banks, effectively realizing an up to 7 step system.
Autocalibration mode	Autocalibration function corrects all errors and detects the current transformer phase shift and each capacitor bank size. No other adjustment is needed.
Line connection	Separate, galvanically isolated control supply terminals can be connected directly to the line or a separate control power line.
Isolated enabling bit input and output pair	Enabling bit I/O pair allows for integration in a supervisory system or connection to an external master. The input interfaces to a NPN (current sink) external control source or enabling signal. It is internally connected to the isolated internal interface power supply and is protected against overvoltage transients. The output features a 24 VDC optotransistor which is protected against overvoltage transients and is isolated from all other AVSR3 supply potentials.
Modes of external control	The “Enable” and “Ready” pair allow for the following DIP switch selectable operation modes: • Standard or static mode: Operation is enabled by the “Enable” input and reported by the “Ready” output. • Tandem mode: A number of AVSR3s are connected in tandem (ie each “Ready” output driving the “Enable” input of the next unit) to realize systems with more capacitor banks. Group control is effected via the “Enable” input of the first unit. • Interlock mode: A number of AVSR3s are connected in a ring (ie each “Ready” output driving the “Enable” input of the next unit in the ring) allowing for only one bank of the group to switch in/out. Used typically with single phase AVSR3s controlling the individual phases of a three phase load to minimize line disturbances when connected to a weak neutral. Group control is effected via a series switch in one of the “Enable” input.
Current detection	By standard 5 A secondary current transformer (CT). The transformer phase shift is detected at autocalibration and, as such, the CT can be placed in any of the phase lines.
Detection method	The reactive current is determined by measuring the current phase and magnitude.
Overheat protected solid state switch	Solid state circuits switch each 25 A compensating capacitor in and out of the line at every sampling instant. Each circuit is protected against overheating, typically caused by bypass relay failure (below).
Zero crossing type solid state switch	The capacitor is switched in when the line voltage equals the capacitor voltage ensuring very “quiet” operation. Capacitor inrush current and the associated generation of harmonics and ringing is eliminated and capacitor life is extended and safeguarded.
Bypass relay	Bypass relay across each solid state switch minimizes switch losses. Its eventual wear-out will trigger the power circuit overheat protection.
Sampling time	DIP switch selectable of 5, 10, 20 and 30 seconds.
Forced state	DIP switch selectable state turns each switch on or off regardless of current input enabling individual power circuit testing or orderly system disconnection.
2x16 character LCD	LCD display shows system state, variable and error messages in user readable and friendly format.
Isolated control circuit	Control circuit is galvanically isolated enhancing safety and noise immunity.
Protection	Against line overvoltages, faults and power circuit overheating.

During normal operation the AVSR3 display indicates system status, error conditions (such as out-of-range line frequency or an overheated switch) and variables such as load/line power factor and power, percentage capacity switched-in and switch state. In the event of a power circuit overheating, the failing switch is deactivated until power is removed. Overheating is usually the result of switch bypass relay failure and in such a case the worn relay must be replaced.

The AVSR3 is highly integrated and adaptable to all power factor capacitor compensation applications. The only other parts required to build a complete power factor correction system are the current transformer, the compensating capacitors and their protective fuses.



Typical three-phase (top) and single-phase (bottom) power factor correction AVSR3 systems. (Model number “ccc” refers to the AVSR3 control voltage and “vvv” to the installation line voltage). In the three-phase system the AVSR3 is powered by a separate control supply, as provided by the shown isolation transformer. The current transformer (CT) phase shift is detected at autocalibration and can be placed in any phase line. In the presence of significant line harmonics, the capacitors must be protected by detuning chokes.



AVSR3 enable input connection (from left to right) to a switch or relay contacts, optotransistor and thermistor. The system is enabled with the switch closed or the optotransistor conducting current. The AVSR3 output (right) is an uncommitted optotransistor and is on when the system is ready.

The AVSR3 can be specially ordered with the LCD on the back so that it can be placed on the cabinet door inside and show through a suitable viewing hole.

Assembled, ready-to-install AVSR3-based systems are available on a custom order basis.

Ordering Information by Line System and Supply Voltage					
Description	**Single phase 110-130 V, 50-60 Hz lines**	**Single phase 220-240 V, 50-60 Hz lines**	**Three-phase 3x220-240 V, 50-60 Hz lines**	**Three-phase 3x400 V, 50-60 Hz lines**	**Three-phase 3x480 V, 50-60 Hz lines**
Triple switch autocalibrating variable step regulator, 110-130 VAC supply	AVSR3-115-1-115	AVSR3-115-1-230	AVSR3-115-3-230	AVSR3-115-3-400	AVSR3-115-3-480
Triple switch autocalibrating variable step regulator, 220-240 VAC supply		AVSR3-230-1-230	AVSR3-230-3-230	AVSR3-230-3-400	AVSR3-230-3-480
Triple switch autocalibrating variable step regulator, 400 VAC supply				AVSR3-400-3-400	
Triple switch autocalibrating variable step regulator, 480 VAC supply					AVSR3-480-3-480

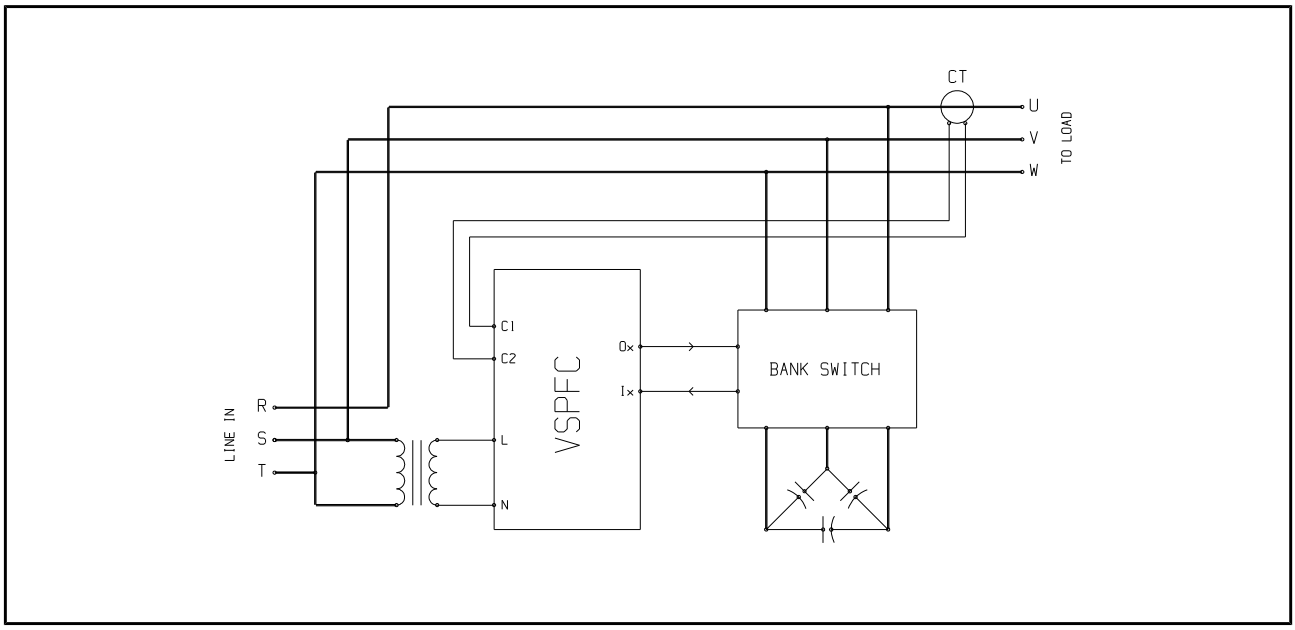
1.b. VSPFC Variable Step Power Factor Controller

The VSPFC variable step controller provides for different capacitor banks of any size to correct power factor in practically any arbitary minimum step and correction range size. At every sampling instant, the controller calculates the required compensation step and connects or disconnects a combination of banks whose sum is equal or closest to the calculated step value. As an example, four banks sized as x5, x2, x2 and x1 multiples of the smallest required step provide a decade of compensating operation and function as a typical ten equal step system. The maximum correction range possible with the VSPFC is when all its 12 outputs are employed in a binary weighted system (x1, x2, x4, x8 .. x2048) and equal to 4095 steps.

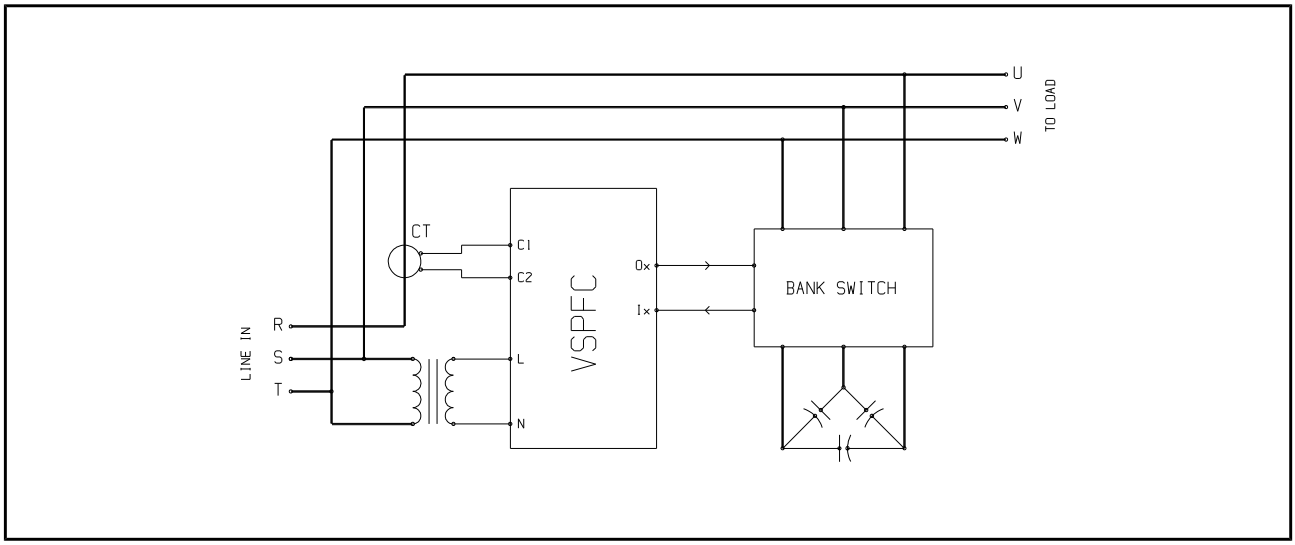
The VSPFC Variable Step Power Factor Controller

VSPFC Feature Summary	
Variable compensating capacitance step	Variable compensating capacitance step can be any combination of the driven banks, effectively realizing an up to 4095 step system.
Compensating or regulating mode	Operates in compensating or regulating mode with the detecting current transformer (CT) either on the line or load side.
Connection	Single- or three- phase connection.
Twelve bit inputs and outputs	Twelve bit inputs and outputs to drive up to twelve capacitor bank switches with individual or group fault/error feedback.
Option to use one bit output to drive a fan	Specific bit output can be assigned to drive a fan as a function of the connected bank size sum.
Current detection with standard transformer	5A CT secondary interface detects the CT apparent current and its phase-detected component (locked to the VSPFC supply voltage).
Dual standard serial port	Dual standard serial communication port: EIA(RS)232 for local communications and/or EIA(RS)485 for connection to Quamatic (p. 91 or similar byte oriented) networks and remote sensors.
Functional front panel	Five digit plus sign LED display with four operator switches on the front panel protected to IP54 and covered by a polyester membrane.
Fully programmable	Fully programmable parameters and function can be set via the front panel or the serial port.
Supplies all relevant quantities	Provides all quantities relevant to power factor control applications regardless of mode (regulating or compensating) and installation type (single- or three-phase) for the line and the load.
Complete integration	Complete integration within a Quamatic (p. 91) or similar network or other supervisory systems via an assigned bit input and output pair.
Operation by non-specialist personnel	Simple, self-contained, unattended operation by non-specialist personnel.
Standard dimensions	Standard front panel cut-out dimensions (per DIN 43700).

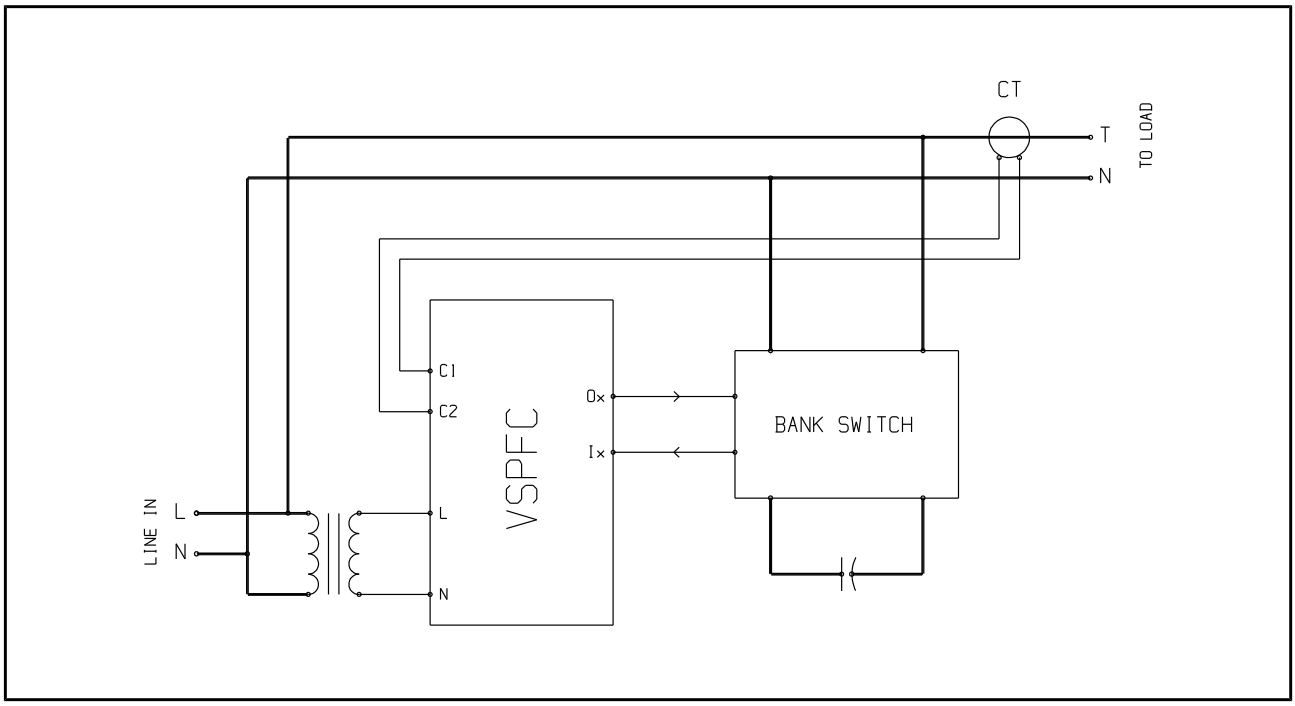
The VSPFC operates in regulating or compensating mode. In regulator mode the current is detected at the line side and equals to the sum of the load and connected capacitor currents. In this mode the Controller switches capacitor banks in and out of the line to minimize reactive current at the line side. In compensator mode the current is detected at the load side and is equal only to the load current. In this mode the Controller switches the banks in and out of the line to compensate the detected reactive load current as closely as feasible by the available bank sizes.



Three-phase VSPFC system operating in compensation mode. The current transformer (CT) detects the load current only. The transformer at the VSPFC supply is used to isolate the system power and control circuits and/or when the line voltage is other than the VSPFC supply. The capacitor bank switches can interface bidirectionally with the VSPFC.

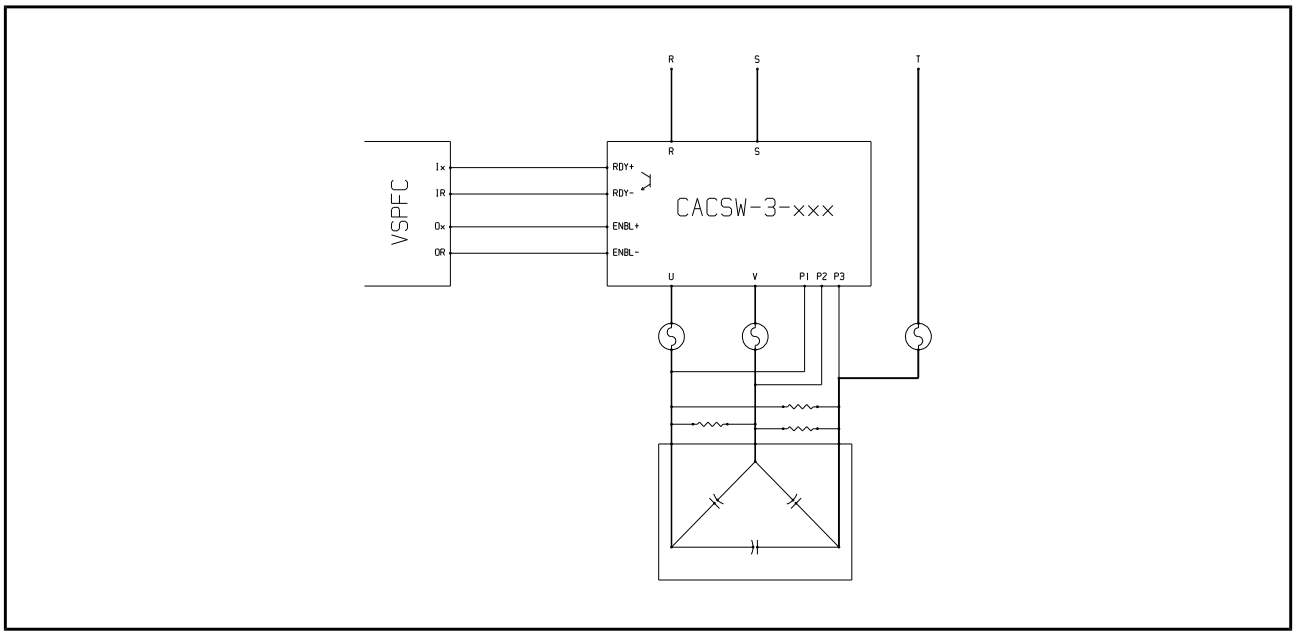


Three-phase VSPFC system operating in regulation mode. The current transformer (CT) detects the load current plus any compensating capacitor bank current. The transformer at the VSPFC supply is used to isolate the system power and control circuits and/or when the line voltage is other than the VSPFC supply. The capacitor bank switches can interface bidirectionally with the VSPFC.



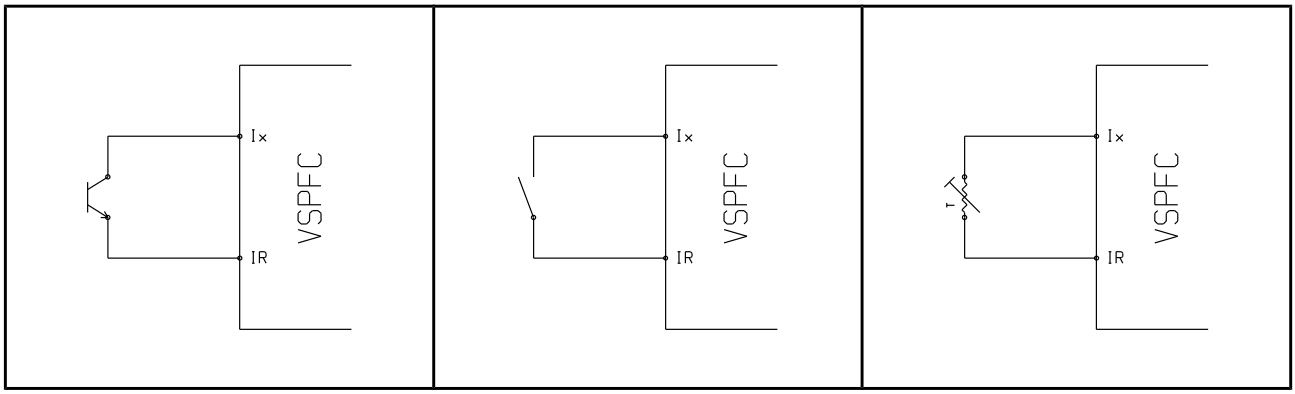
Single-phase VSPFC system operating in compensation mode. The current transformer (CT) detects the load current only. The transformer at the VSPFC supply is used to isolate the system power and control circuits and/or when the line voltage is other than the VSPFC supply. The capacitor bank switches can interface bidirectionally with the VSPFC.

The Controller bit outputs feature 24 VDC optotransistors commoned in NPN (current sink) type. They are protected against overvoltage transients and are isolated from all other Controller supply potentials.



Direct VSPFC interface to a CACSW capacitor bank switch. The CACSW is driven by the VSPFC, detects the capacitor fuses state and reports it via its "Ready" output.

The VSPFC bit inputs are of NPN (current sink) type and are used to interface to any capacitor bank switch status feedback or enabling signal. They are internally connected to the galvanically isolated internal interface power supply and are protected against overvoltage transients.



VSPFC enable bit inputs driven by an open collector, NPN, current sink source (left), switch or relay contacts (middle) and PTC thermistor (right).

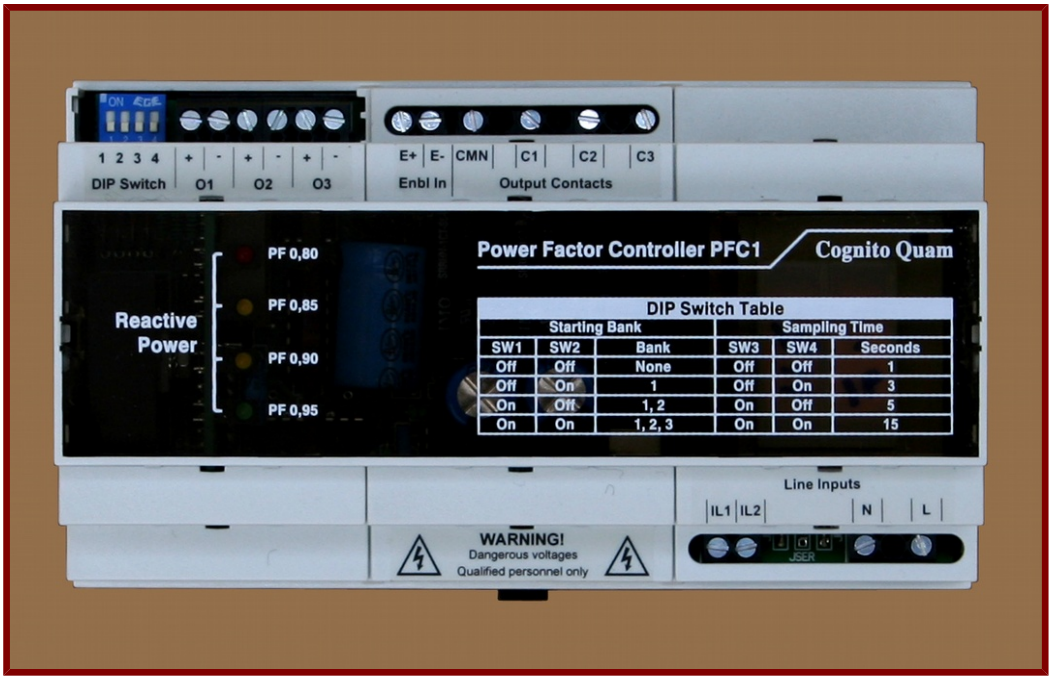
Ready-to-install, completely assembled systems are available on a custom order basis.

Ordering Information	
Model	**Description**
VSPFC-115	Variable step power factor panel controller, 115 VAC, 50-60 Hz supply
VSPFC-230	Variable step power factor panel controller, 230 VAC, 50-60 Hz supply

1.c. PFC1 Fast Power Factor Controller

The PFC1 controller measures the phase angle between the voltage and current vectors in a single- or three- phase line system and activates its three-step output to switch in and out of the line compensating capacitor banks. The current is detected with a standard current transformer (CT) in one of the line phases and measurement duration is selectable from 1 to 15 seconds.

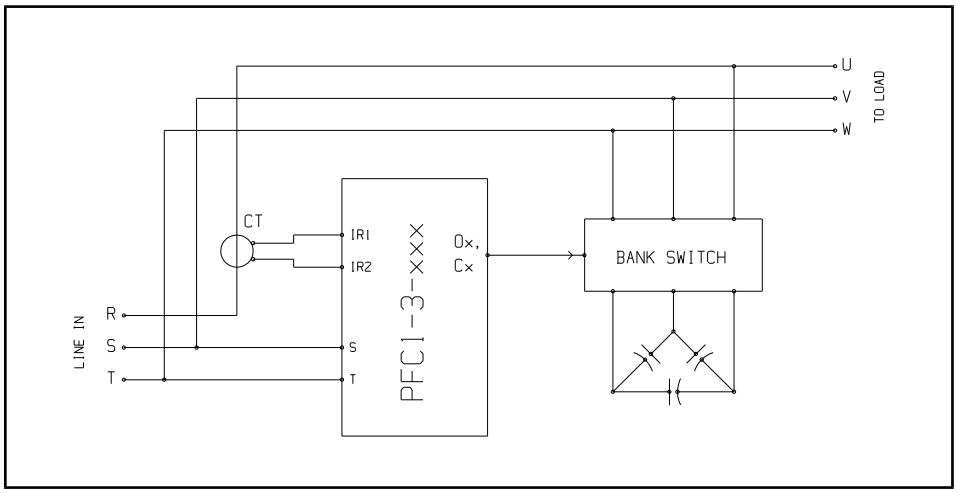
The PFC1's fast response makes it particularly suitable for very fast dynamic compensation of frequently-started, low-duty or variable loads such as lifts, conveyors, pumps and fans.



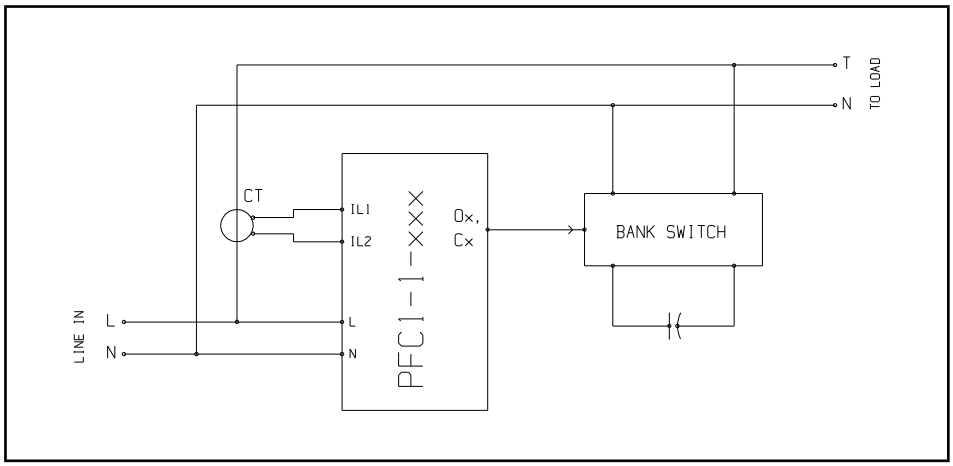
The PFC1 Controller

The controller is active while the CT secondary current is above 0.5 A (10 % of range) and enabled at the external control input. On activation the outputs are initialized as selected at the DIP switch until the first measurement is completed. If the measured power factor is above 0.95 the outputs remain unchanged until the next measurement is completed. The outputs are incremented (the next step output is activated) for inductive power factors below 0.95 and the activated output protection time-out has elapsed. Correspondingly, the outputs are decremented (the highest step output is deactivated) for capacitive power factors below 0.95.

PFC1 Feature Summary	
Line connection	No connection to the neutral is required for three-phase models
Current detection	By standard 5 A secondary current transformer (CT)
Controller activation limit	0.5 A in the CT secondary (10 % of CT range) ensures reliable, robust and noise-free controller operation
Three-step output system	Switches the compensating capacitor banks progressively in and out of the line at every measured sample
Dual type galvanically isolated outputs	Directly drive solid state relays (SSR) and/or higher voltage loads such as contactors. The SSRs can be driven directly by the 24 VDC outputs while contactors are controlled via the PFC1 isolated contact outputs.
External control input	Control input to interface to external master devices or thermal protection sensors.
Measurement time	DIP switch selectable averaging/sampling time of 1, 3, 5 and 15 seconds
Initial output state	DIP switch selectable at controller activation until the first measurement is ready to immediately compensate known loads
DIP switch changes	Immediately effective at the next controller activation
Four LED display	Simple and intuitive display indicates the measured power factor and controller status
Comprehensive error handling	Handles reverse current transformer connection, out-of-range line frequency (valid range is 45 - 66 Hz) and line faults. Outputs are deactivated during a fault and the error clears after its cause is removed.
CT phase error compensation	The phase error introduced by the current transformer is compensated by a programmable amount.
Capacitor bank time-out protection	Time-out after deactivation allows proper capacitor discharging before next switch-in.
Protection	Line inputs are protected against line overvoltages and faults. 24 VDC outputs are protected against over-voltages and are current-limited.
Enclosure	DIN rail mountable plastic enclosure, 157x90x58 mm.

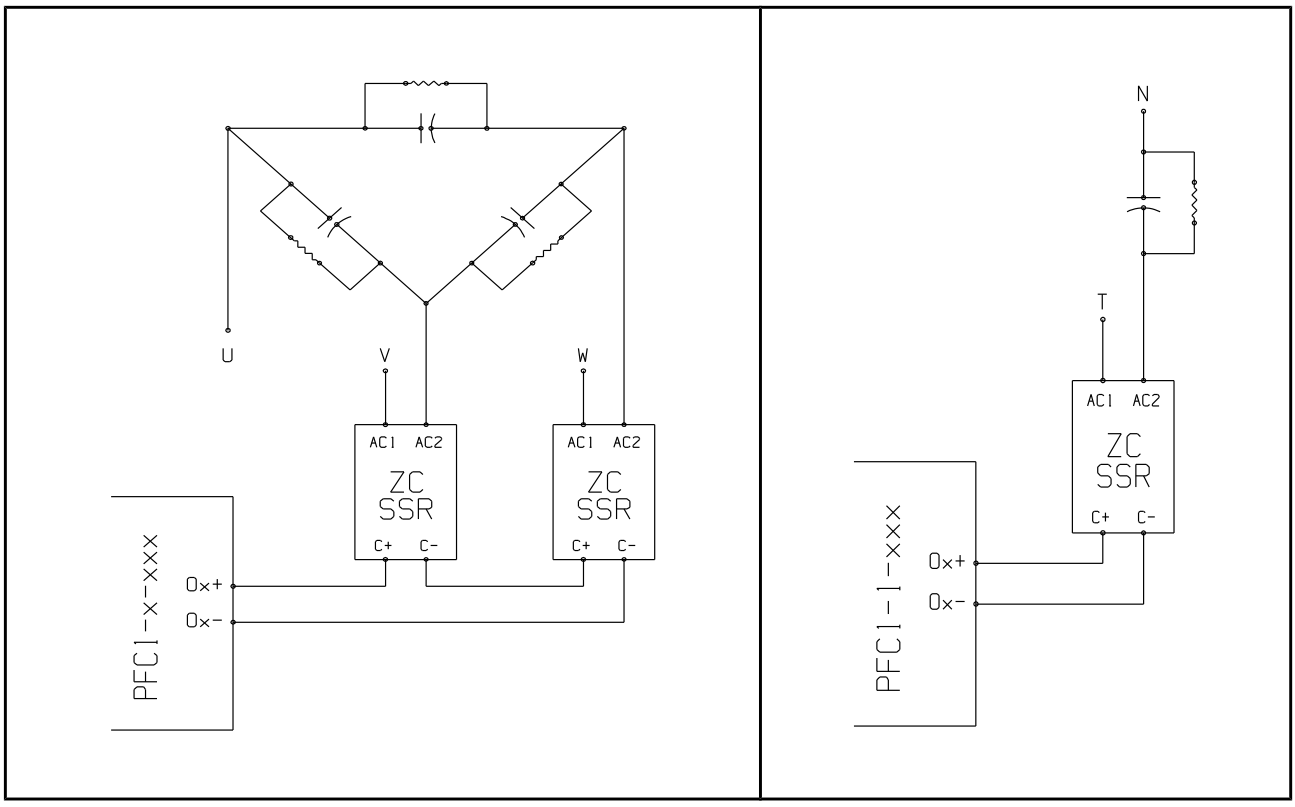


Typical three-phase power factor correction PFC1 system. Only one capacitor bank is shown for clarity. The bank switch can either be a set of solid state switches or a relay contactor.



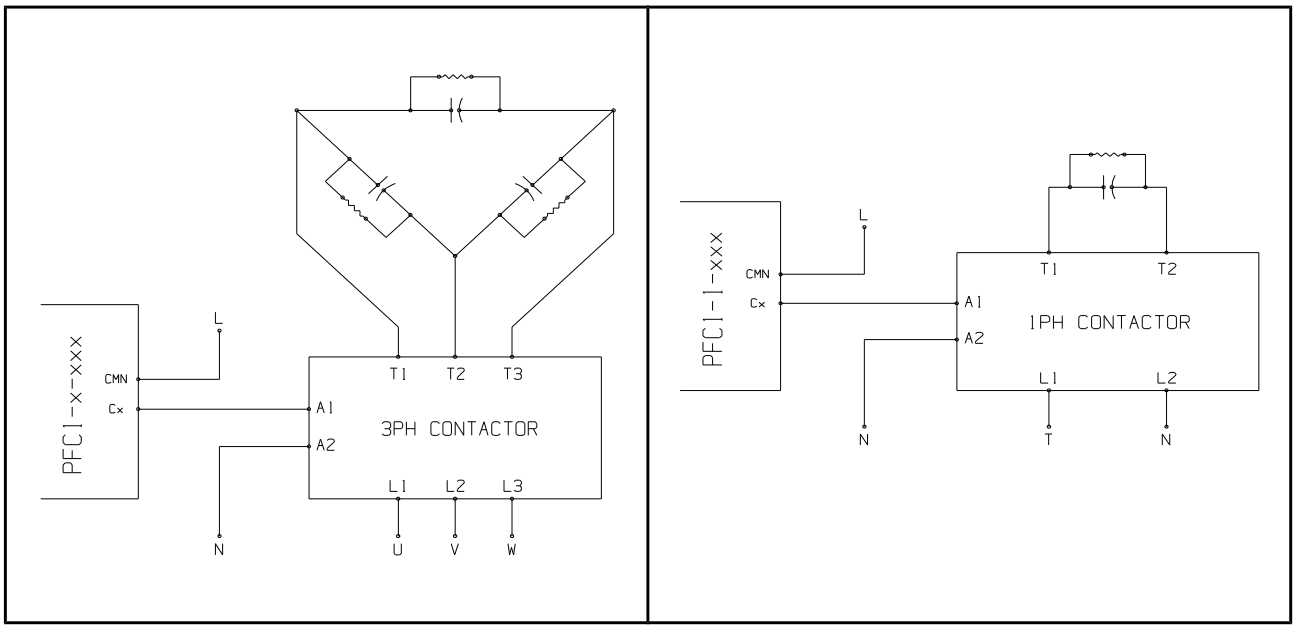
Typical single-phase power factor correction PFC1 system. Only one capacitor bank is shown for clarity. The bank switch can either be a set of solid state switches or a relay contactor. A single-phase model can also be used in a three-phase system with neutral by connecting to the detected current line and the neutral.

Each PFC1 24 VDC output is current-limited by 210 Ohms of resistance and protected against overvoltages and reverse inductive current. It can typically drive two or three SSRs (one at each controlled arm) connected in series with 20 mA control current.



Typical solid state relay bank switch connection in three-phase (left) and single-phase (right) line systems. The SSRs must be of the zero-crossing (or line synchronized) type to ensure that the capacitors are switched in when the line voltage equals the capacitor voltage thus eliminating capacitor inrush current and extending capacitor service life. The capacitor discharging resistors are for safety only and can be any suitable value giving minimum heat dissipation while connected to the line.

The PFC1 contact outputs are common-connected, normally-open, potential-free types and can switch up to 4 A loads at 240 VAC.



Typical contactor bank switch connection in three-phase (left) and single-phase (right) systems. The control voltage live (typically 230 VAC) is switched to activate the contactor coil.

The contactor must be of special two stage design limiting capacitor inrush current at bank switch in.

The capacitor discharge resistors should be sized to optimally bring down the capacitor voltage before a possible bank switch-in (within the DIP selectable capacitor protection time-out) minimizing average capacitor inrush current.

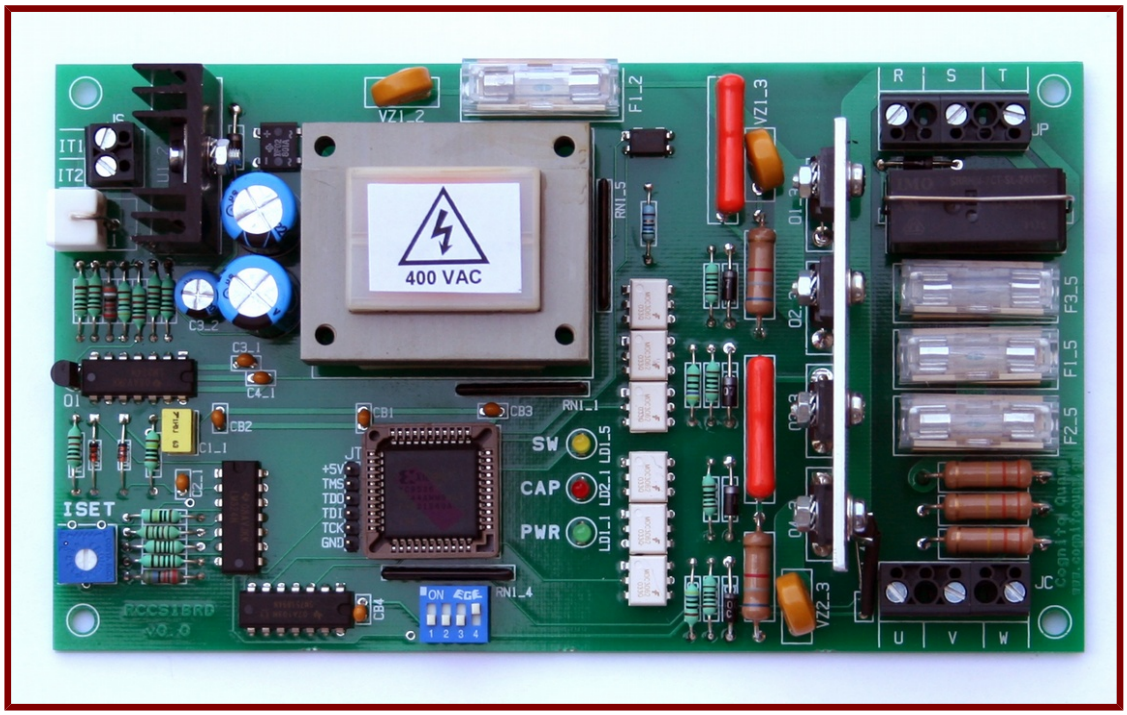
Ready-to-install, completely assembled systems in wall mountable cabinets are available on a custom order basis.

Ordering Information by Line System				
Description	**110-120 V**	**220-240 V**	**400 V**	**480 V**
Single-phase PFC1 fast power factor controller	PFC1-1-120	PFC1-1-240		
Three-phase PFC1 fast power factor controller	PFC1-3-120	PFC1-3-240	PFC1-3-400	PFC1-3-480

1.d. Single (RCCS1) and Triple (RCCS3) Reactive Current Controlled Switch

The new (v1.1) RCCSx switches measure the reactive current in single- and three- phase line systems and activate one (RCCS1) or three (RCCS3) 8 A solid state switches to connect compensating capacitors in and out of the line system. The current is detected with a current transformer (CT) in one of the lines and the sampling period is selectable from 4 to 32 seconds.

The RCCSx response makes it particularly suitable for fast dynamic power factor (PF) compensation of frequently-started, low-duty or variable loads such as lifts, conveyors, compressors, pumps and fans.

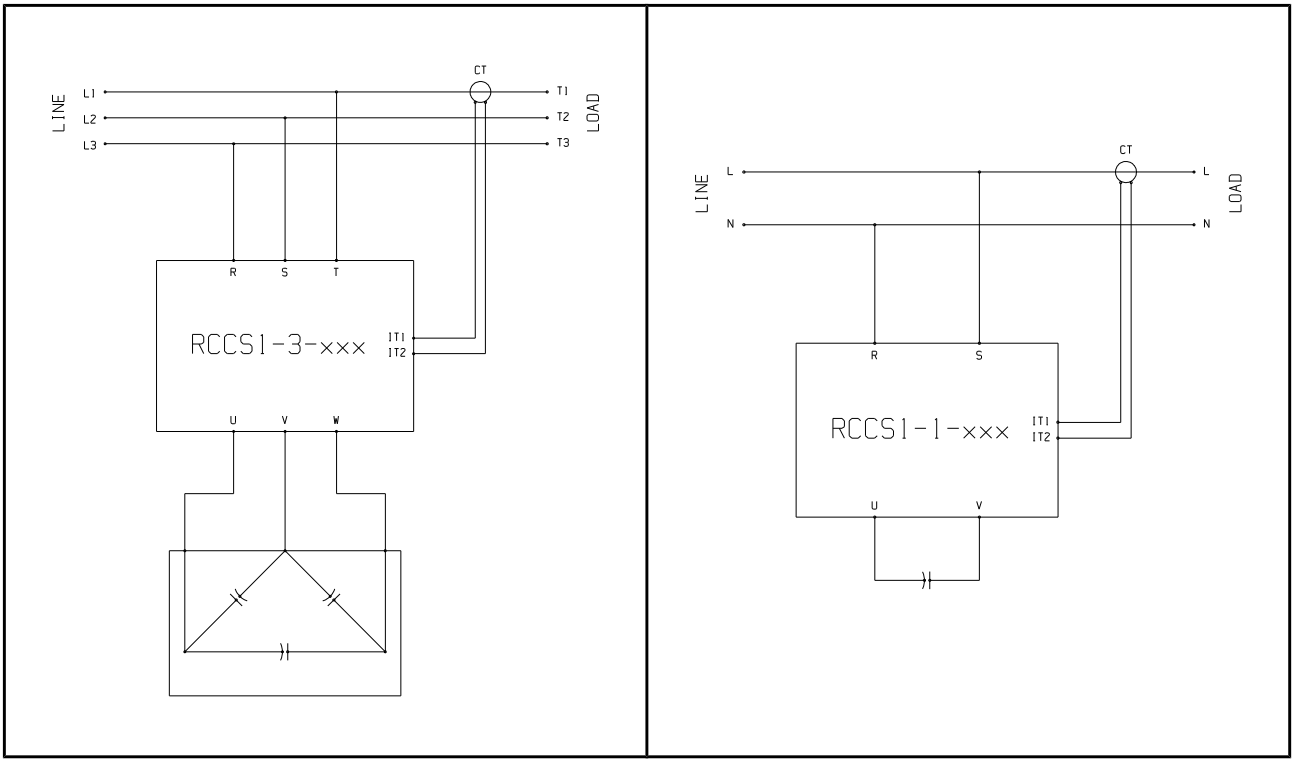


The RCCS1 v1.1 single switch

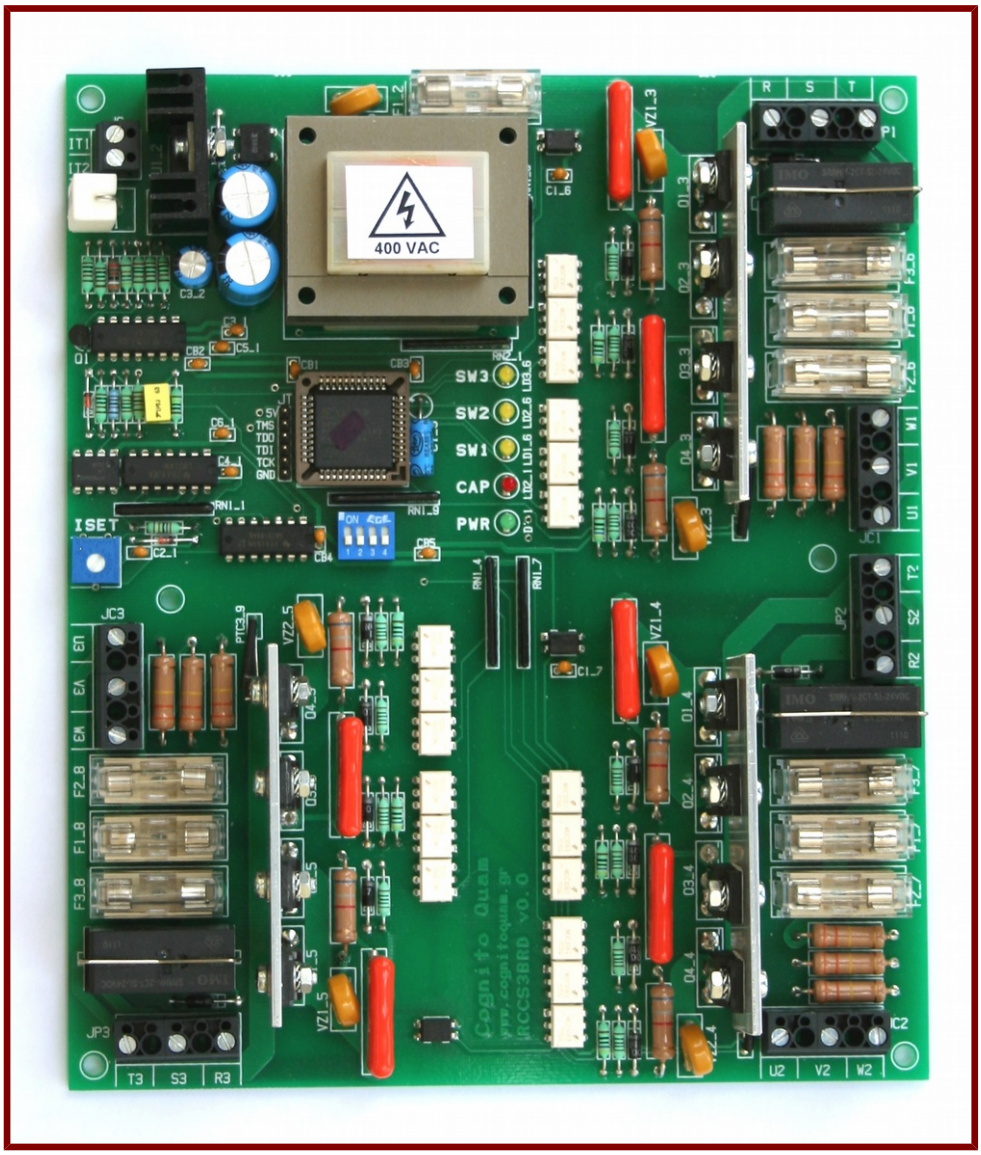
Each switch is activated when the detected reactive current is above the respective set value as determined at the activation potentiometer. Switch activation/deactivation happens at every sampling instant as set at the DIP switch.

The RCCSx is a fully protected, digitally-controlled unit, simple to install and adaptable to all power factor capacitor compensation applications. The only other parts required to build a complete power factor correction system are the current transformer and the compensating capacitor(s).

RCCSx Feature Summary	
Line connection	No neutral connection for the three-phase models.
Current detection	By standard 5 A secondary current transformer (CT).
Reactive current activation range	Activation potentiometer range of 0.3 - 3 Ar (measured at the current transformer secondary) ensures versatile and scalable operation.
Phase sensitive detection method	Reactive current is measured by phase sensitive detection rejecting noise and line harmonic effects.
Overheat protected solid state relay	Solid state relay circuits switch each 8 A compensating capacitor in and out of the line at every sampling instant.
Zero crossing type solid state relay	The capacitor is switched in when the line voltage equals the capacitor voltage thus eliminating capacitor inrush current and extending service life.
Bypass relay	Bypass relay across each solid state switch minimizes switch losses.
Sampling time	DIP switch selectable of 4, 8, 16 and 32 seconds.
Forced state	DIP switch selectable state turns each switch on or off regardless of current input enabling individual power circuit testing or orderly system disconnection.
Indicating LEDs	LEDs show the power supply state, each switch activation/overheat status and the capacitive PF condition (or a reverse connected current transformer).
Bleed resistors	Capacitor bleed resistors ensure charge-free capacitors after shut-down.
Isolated control circuit	Control circuit is galvanically isolated enhancing safety and noise immunity.
Protection	Against line overvoltages, faults and power circuit overheating.

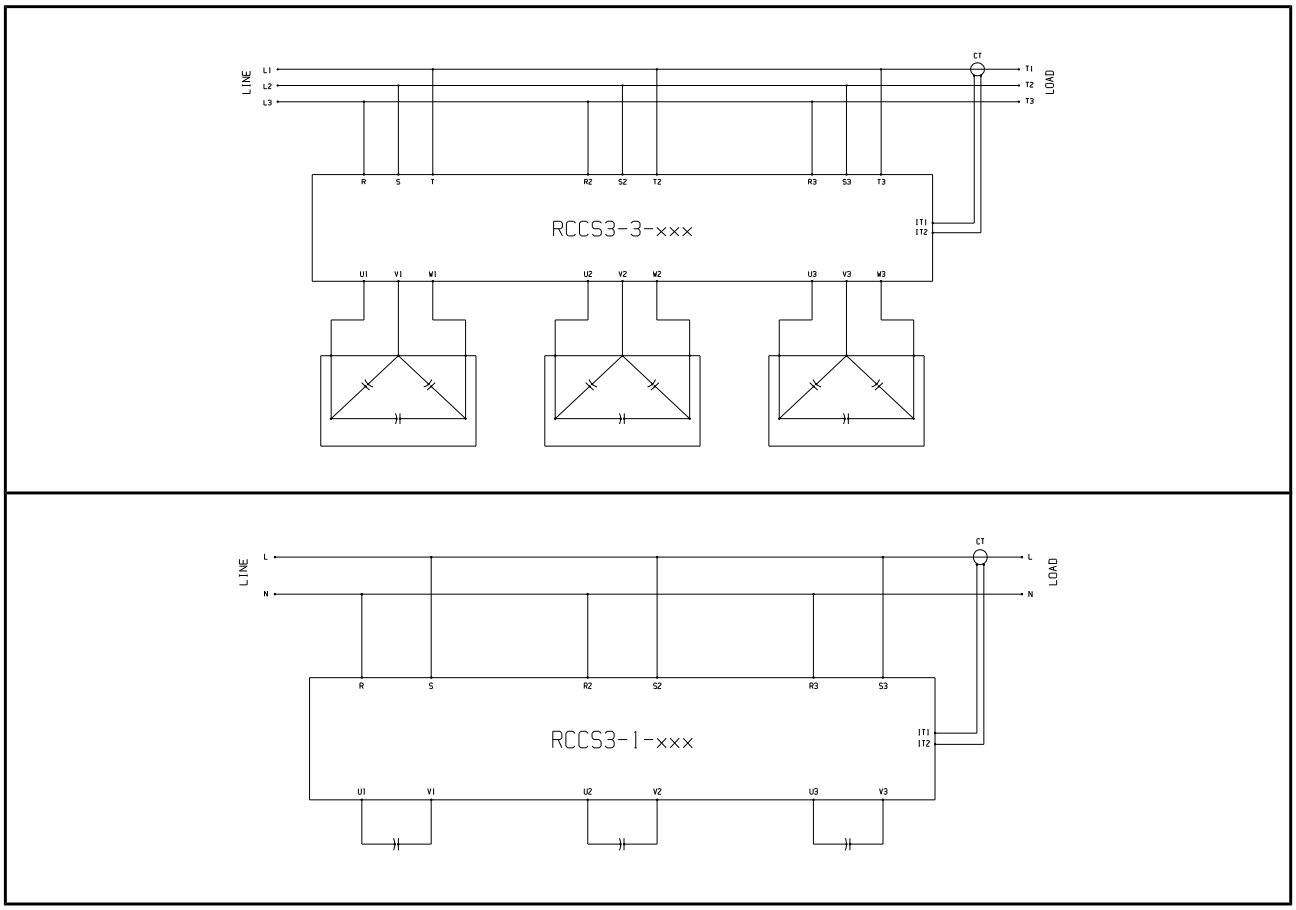


Typical three-phase (left) and single-phase (right) power factor correction RCCS1 systems.



The RCCS3 v1.1 triple switch

During normal operation each “Switch ON” LED indicates the on or off condition of the relevant switch. In the event of its power circuit overheating, the switch is deactivated and the “Switch ON” LED flashes until power is removed. Overheating is usually the result of switch bypass relay failure and in such a case the worn relay is easily removed from its socket and replaced.

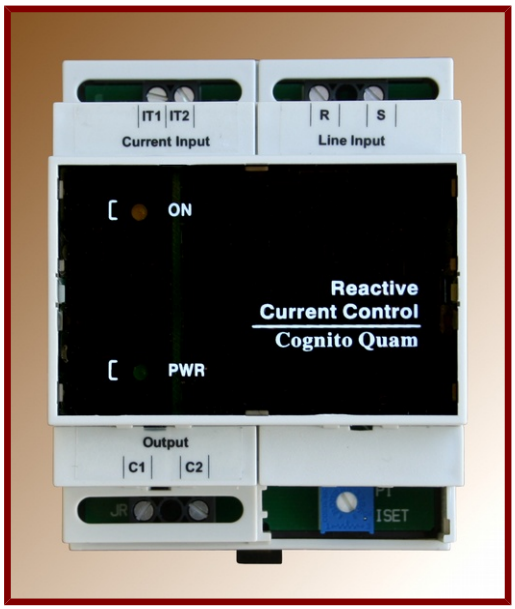


Typical three-phase (top) and single-phase (bottom) power factor correction RCCS3 systems.

Ordering Information by Line System					
Description	**120 V, 60 Hz lines**	**230 V, 50 Hz lines**	**240 V, 60 Hz lines**	**400 V, 50 Hz lines**	**480 V, 60 Hz lines**
Single-phase RCCS1 single reactive current controlled switch	RCCS1-1-120	RCCS1-1-230	RCCS1-1-240		
Three-phase RCCS1 single reactive current controlled switch	RCCS1-3-120		RCCS1-3-240	RCCS1-3-400	RCCS1-3-480
Single-phase RCCS3 triple reactive current controlled switch	RCCS3-1-120	RCCS3-1-230	RCCS3-1-240		
Three-phase RCCS3 triple reactive current controlled switch	RCCS3-3-120		RCCS3-3-240	RCCS3-3-400	RCCS3-3-480

1.e. RCCx-xxx Reactive Current Control

The RCCx reactive current control detects reactive current in a single- or three- phase line and closes its output contacts if above the set limit. It can thus dynamically compensate low inductive power factor lines by signaling the need to switch capacitors in and out of the line. It is very simple to install and adaptable to all power factor compensation applications.



Three-phase reactive current control RCC3-xxx.

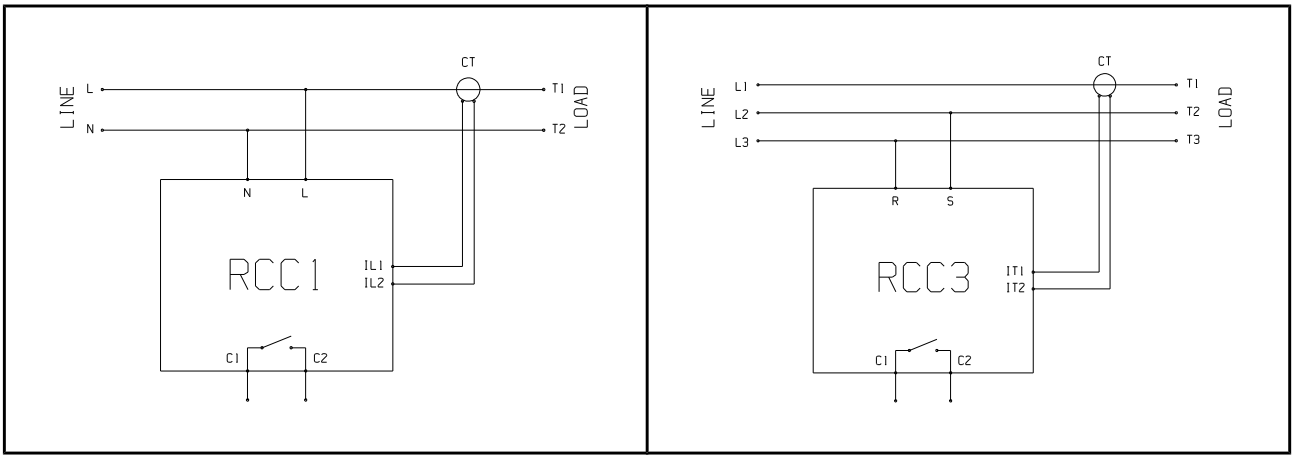
The RCC measures the reactive current in a single-phase (RCC1-xxx models) or three-phase (RCC3-xxx models) system and closes the 12 A output contacts when the monitored reactive current is above the preset value. The current is detected with a current transformer (CT) in one of the phase lines with a maximum response time of 30 seconds.

The RCC response time makes it particularly suitable to activate contactor switched capacitor banks in dynamically compensating low-duty or variable loads such as:

- Lifts,
- Conveyors,
- Compressors,
- Pumps,
- Fans, and
- Office lighting.

The RCC is designed for single-phase (RCC1-xxx models) or three-phase (RCC3-xxx models) lines. Characterizing features are shown in the following table.

RCCx-xxx Characteristics	
Three-phase line connection without neutral	The RCC3-xxx connects to two of the three-phase lines and no connection to the neutral.
Current detection	By standard 5 A secondary current transformer.
Reactive current activation range	Activation potentiometer range of 0.3 - 3 Ar (measured at the current transformer secondary) ensures versatile, reliable and robust operation.
Phase sensitive detection method	Reactive current is measured without being affected by noise and harmonics in the line.
Output relay contacts	12 A output relay contacts are closed when the detected reactive current is above the set value at the activation potentiometer.
Indicating LEDs	LEDs show the power supply and relay activation state.
Control circuit	Isolated control circuit enhances safety and noise immunity.
Protection	Protection against line overvoltages and faults.



Connection diagram of an RCC1-xxx to a single-phase line (left) and an RCC3-xxx to a three-phase line (right).

Ordering Information by Line Voltage					
Description	**120 V, 60 Hz lines**	**230 V, 50 Hz lines**	**240 V, 60 Hz lines**	**400 V, 50 Hz lines**	**480 V, 60 Hz lines**
Reactive current control, single-phase	RCC1-120	RCC1-230	RCC1-240		
Reactive current control, three-phase	RCC3-120		RCC3-240	RCC3-400	RCC3-480

1.f. PFCDxx-xxx Power Factor Current Detector

The PFCDxx-xxx power factor current detector measures the apparent and either the active or reactive current in a single- or three- phase power line to respectively produce a set of two 10 VDC analog signals. The two outputs can then be used by a PLC or other controlling device to calculate line power factor as well as monitor the applicable active or reactive current characteristics. It is very simple to install and adaptable to all power factor compensation applications.

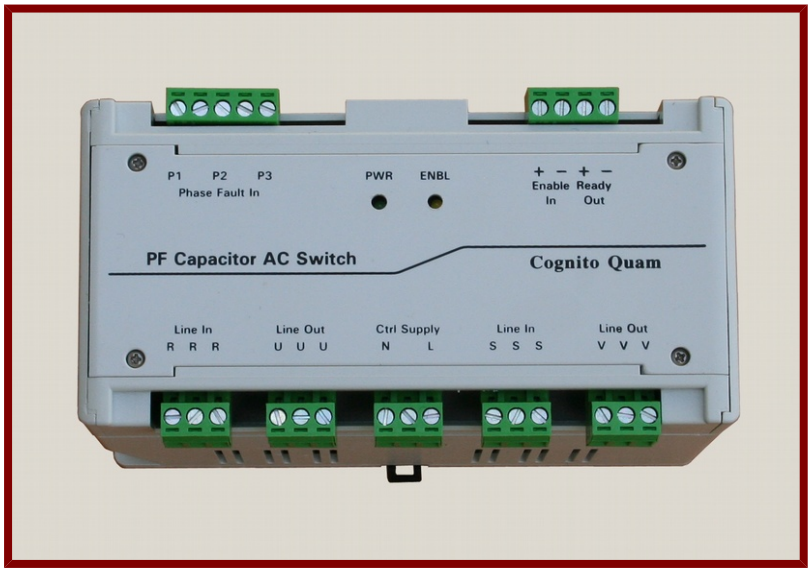
Power Factor Current Detector PFCD1R

The PFCD measures the power factor related currents in a single-phase (PFCD1x-xxx models) or three-phase (PFCD3x-xxx models) system and produces a unipolar 0-10 VDC signal representing the apparent current and a bipolar ±10 VDC signal representing the active (PFCDxA-xxx models) or reactive (PFCDxR-xxx models) current. The current is picked up with a current transformer (CT) in one of the phase lines with a response time of about 3 seconds.

For a detailed description of the detector and the applicable ordering codes see p. 67.

1.g. CACSW Integrated Power Factor Capacitor AC Switch

The CACSW connects a single- or three- phase 25 A power factor capacitor bank to the line, employing bypassed, zero crossing, solid state thyristor switches. Its phase fault detector can be used to either monitor the line for phase integrity or the capacitor bank circuit for fuse state as well as line faults.



The CACSW PF capacitor AC switch

The CACSW solid state thyristor switches connect to the capacitor bank at zero voltage difference without any disturbing inrush currents. They are then bypassed by a relay to eliminate all thyristor conduction losses and are protected against overheating, typically caused by failure of the relay contacts. The control input is digitally filtered to reject noise and the unit responds within a maximum time of 2.5 seconds.

For a detailed description of the controller and the ordering codes see p. 63.

2. ROBOTICS AND MOTION CONTROL PRODUCTS

2.a. Motion One Position/Motion Controller

Our Motion One controller is designed to perform all the motion control chores in the movement between four programmable positions and two “soft” limits.

Motion One controller front view

Typical applications are material-in and material-out tables/belts as well as tool/workpiece positioners.

The six positions are “taught” in a “learning” session, whereby the controller is taken through the desired locations. No further motion control software or programming is required at installation or normal operation as all the necessary calculations are performed by the controller. Furthermore, the controller continuously monitors the driven system for static friction and elasticity (or vibration).

The controller can operate on its own whereby the various commands can be generated by switch contacts or as a slave to a master controlling device (such as a PLC).

Encoder signals are employed as the position input. These are internally filtered (as with our Terminator filters) and processed to generate the analog velocity output. For low accuracy systems, the velocity output is quantized in four levels by four bit outputs (a typical application being an inverter driven at four programmed speeds). The I/O interface also features two control commands (“learn” and “reset”) and four bit outputs (“idle”, “direction”, “learn” and “fault”) which can be used to activate brakes, indicating signals and so on.

Ordering Information	
Model	**Description**
Motion1	Motion One position/motion controller

2.b. Elevation Distributed Lift Control

The Elevation lift control system consists of a number of distributed board-level units which are organized in a EIA(RS)485 multidrop network and process the lift installation inputs in controlling the overall lift operation. It consists of the following units:

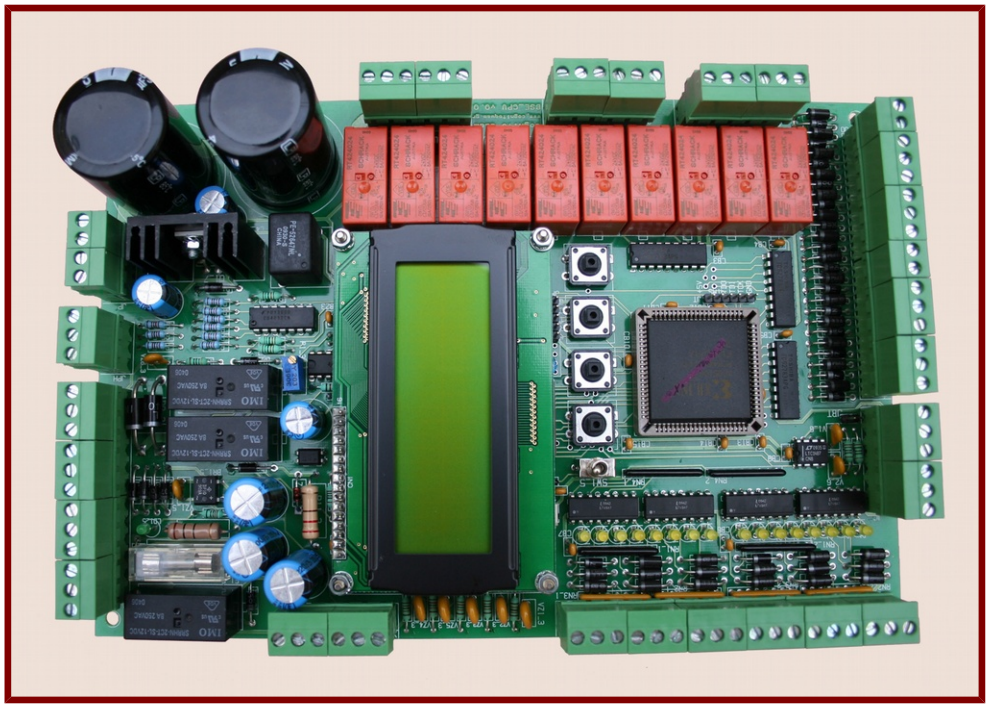
- The machine room unit (ElevationBase) which handles safety and local automation in controlling lift motion and car door operation. In addition it controls system back-up and car evacuation operations in the absence of line power.
- The car unit (ElevationCar) which processes and communicates all car signals and transport demands to the ElevationBase unit and controls car door, fan and light activity.
- The floor unit (ElevationFloor) which processes and communicates all floor level signals and transport demands to the ElevationBase unit and controls the floor level indication and call activity.

All system inputs are fully protected against overvoltages and reverse polarity connection. Each input signal is processed by a noise rejecting DSP filter and its logic state (positive/negative logic) is specified at the unit operation parameters.

All 24 VDC outputs are protected against overvoltages, reverse polarity connection, reverse load current and inductive spikes.

System Attributes	
Car location	The car position is determined after decoding the 4 predefined inputs at either the ElevationBase or the ElevationCar unit. The decoding is performed under various protocols which are selectable from the operation parameters. Car position at start-up is initialized as a homing manouvre at the upper or lower travel ends as specified by the operation parameters.
Call management	System call management is fully parametric and programmable. The call service policy and the sound and visual floor announcements are set from the operation parameters. The current version (v0.r0) features the following call service policies: • Floor to floor, bidirectional call and service, no intermediate stops. • Floor to floor, bidirectional call and service, with intermediate stops. • Floor to direction service, bidirectional call, no intermediate stops. • Floor to direction service, bidirectional call, with intermediate stops. • Ascending service only. • Descending service only. The serviced floors and call sources are specified and activated by the operation parameters.
Motion control	The motion characteristics and the car speed command are specified for each floor for both lift types (mechanical/hydraulic). In addition, the approach and decelaration speed is specified for each floor as well as the number of floors required to stop the car. A post-stop hydraulic pressure release delay is also programmable via the parameters.
Maximum number of floors, future additions	The maximum number of managed floors is 63. Current development work is addressing the coordinated operation of mechanically independent lifts and car location with position encoders.

2.b.1. The ElevationBase machine room unit



The ElevationBase machine room unit

The ElevationBase machine room unit consists of the following subsystems:

- 5 110 VAC safety signal inputs: end travel, shaft emergency stop, floor doors, car door and door latch. The signals are processed by the DSP noise filter and checked for logic integrity.
- 16 24 VDC NPN (active low) predefined inputs: car location, maintainance manouvres, motor thermal protection, external events (earthquake, fire alarm), car full-load and overload condition and, correct motion contactor operation. Each input state is indicated by a dedicated LED.
- Line undervoltage and phase integrity/sequence monitor.
- 10 NO (“Normally Open”) 12 A predefined contact outputs: door latch, general motion, motion up, motion down and 4 speed types. Depending on the lift type the 4 speed types are decoded as mechanical ¨slow¨, ¨fast¨, ¨other¨ and ¨maintaince¨ speeds or hydraulic ¨up slow¨, ¨down slow¨, ¨up fast¨ and ¨down fast¨ types.
- 14 predefined 24 VDC, 0,5 A peak, PNP, active high outputs: 6bit position, ascend, descend, alarm, sound gong, fault, ready condition and spare.
- Unregulated 24 VDC power supply, with up to 10 A available for external 24 VDC loads.
- Internal 5 VDC switching power supply, back-up and car evacuation battery charger and battery commutation and car evacuation control in the absence of line power.
- Microprocessor based controller featuring system parameter memory, real time clock, event log, 4x20 character LCD display, operator input with 4 tactile switches and one enabling lever switch and EIA(RS)485 serial communication port.

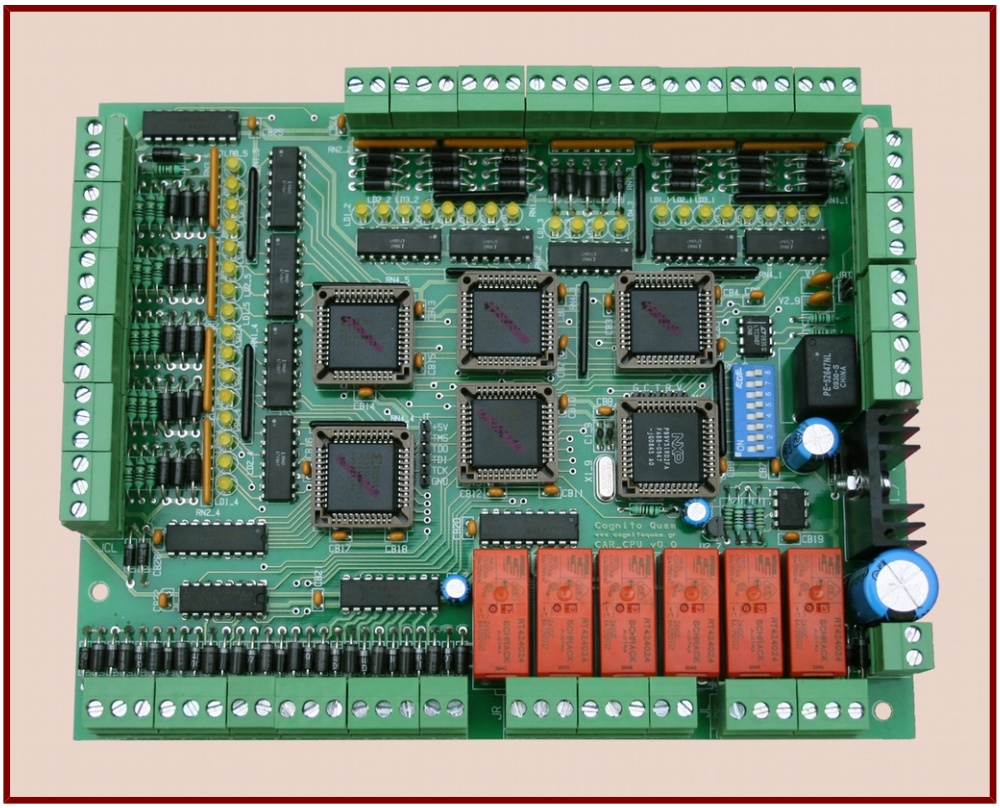
The ElevationBase unit communicates with the ElevationCar and ElevationFloor units and performs the lift manouvres as required by the received calls, the selected call service policy, the various installation devices state and the activation of external event alarms.

Connections to the unit are made with removable terminal blocks.

2.b.2. The ElevationCar unit

The ElevationCar unit processes the locally available car signals, communicates them to the ElevationBase unit and controls the overall operation of up to two car doors.

Car call management is performed locally under the supervision of the ElevationBase unit. The number of managed calls is expandable with additional ElevationCar units.



The ElevationCar unit

The ElevationCar unit features the following subsystems:

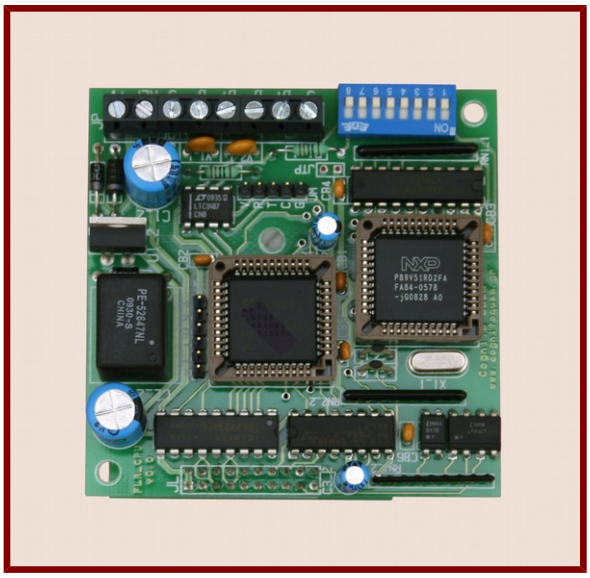
- 20 predefined 24 VDC NPN (active low) inputs: location sense, maintainance manouvres, door light beams, door terminal switches, internal operation (door open, door close, express call, car full and car overload and manual/automatic fan and light operation). Each input state is indicated by a dedicated LED.
- 16 24 VDC NPN (active low) call inputs with call source latch. The state of each call input is shown by an individual LED. Each call is parametrically characterized as ¨common internal¨, ¨common external¨, ¨external up¨ or ¨external down¨.
- 4 predefined NO (“Normally Open”) 12 A contact outputs to control the opening and closing of up two doors.
- 2 predefined CT (“Normally Open” and “Normally Closed”) 8 A contact outputs to drive the car fan and lights.
- 14 predefined 24 VDC, 0,5 A peak, PNP, active high outputs: 6bit position, ascend, descend, full load, oveload, sound gong, fault, alarm condition.
- Car evacuation circuit which complements the ElevationBase evacuation circuits.
- Internal 5 VDC switching power supply.
- Microprocessor based controller with local operation parameter memory, EIA(RS)485 serial communication port and 8 position DIP switch.

The operation parameters are specified and loaded by the ElevationBase unit while the DIP switch sets the unit network address and the local/remote car position location.

Connections to the unit are made with removable terminal blocks.

2.b.3. The ElevationFloor unit

The ElevationFloor unit features the following subsystems:



The ElevationFloor unit

- 1 predefined 24 VDC NPN (active low) input for fire alarm.
- 2 24 VDC NPN (active low) call inputs with call source latch: ¨ascend call¨ and ¨descend call¨.
- 8 24 VDC, 0,5 A peak, PNP, active high outputs: 6bit position, ¨ascend¨ and ¨descend¨.
- 2 call LED 24 VDC NPN (active low) outputs.
- 1 predefined 24 VDC NPN (active low) sound gong output.
- Microprocessor based controller with local operation parameter memory, EIA(RS)485 serial communication port and 8 position DIP switch.

The unit processes and communicates the locally available inputs to the ElevationBase unit and manages the local calls under the supervision of the ElevationBase unit.

The operation parameters are specified and loaded by the ElevationBase unit while the DIP switch sets the unit network address, the common use of the ascend and descend calls and the communication port termination.

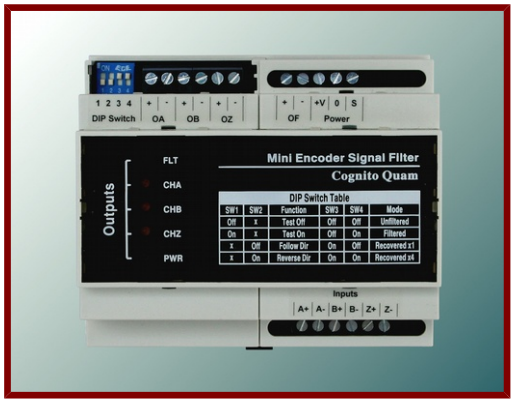
Connections to the unit are made with fixed terminal blocks.

Ordering Information	
Model	**Description**
ELVB	ElevationBase
ELVC	ElevationCar
ELVF	ElevationFloor

2.c. Multimode Encoder Signal Filters

The encoder, in rotary or linear form, is a motion/position control staple and our filters complement and extend their capabilities and performance.

Terminator multimode encoder signal filter



Mini multimode encoder signal filter

The filters remove all types of electrical noise (common and differential mode, dV/dt transients, ground loop generated etc.) in the encoder signal lines as well as the corrupting effects of mechanical noise and vibration (phantom movement, dither etc.). The filters reconstruct the encoder signals to reflect the correct encoder position and speed signaling. Performance is safeguarded and problems such as:

- Motion system position drift,
- Home reference loss,
- False triggering of the receiving inputs, and
- Receiving input saturation, latch-up or failure

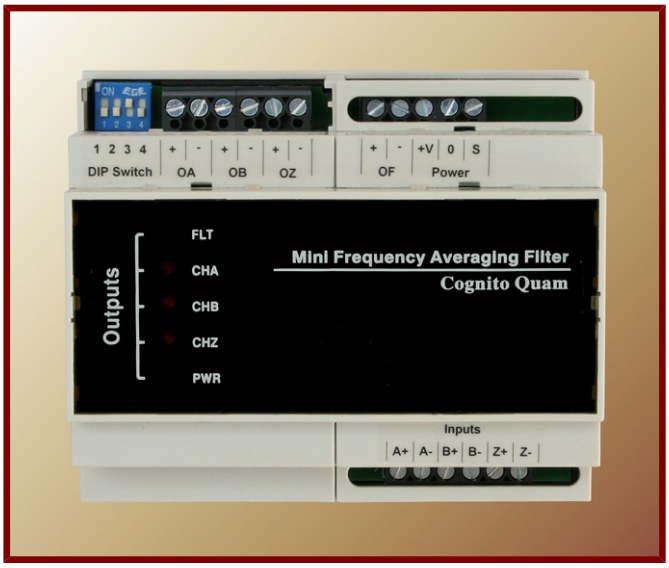
are eliminated.

For a detailed description of the filters, their technology and ordering codes see p. 72.

2.d. Multimode Frequency Averaging Filters

The multimode frequency averaging filter is the signal processing extension of our well established Terminator encoder signal filters. While the signal filters clean-up and ensure the electrical and low-level integrity of the encoder signals, the averaging filters, in addition, process these signals to reproduce them at average input frequency.

This specialty filter is particularly suited to slow moving production lines where the ideal control variable is average, and not instantaneous, speed. This happens because instantaneous speed varies randomly due to external events and systematically due to the various coupled, but uncontrolled, mechanisms to the plant power train. As such instantaneous speed cannot be effectively controlled as its measurement is randomly biased and noisy. In contrast, average speed measurement contains only the net effect of these uncontrolled mechanisms and does not allow them to corrupt speed measurement control.



Mini multimode frequency averaging filter in DIN rail IP40 enclosure

Typical applications of the averaging filters are:

- Slow pipe extrusion lines, where raw material feeding (and cost!) is a function of the long-averaged extrusion speed.
- Reciprocating machinery (such as weaving) speed control, whereby performance, energy and operational costs are optimized by controlling average motion speed,
- Engine speed monitoring and control, where shaft rotation is anything but smooth, and
- Vane or turbine flowmeters, where vane vibration due to turbulent flow corrupts rate or dose measurement.

For a detailed description of the filters, their technology and ordering codes see p. 77.

2.e. ISFT Intelligent Motor Starting Panel Controller

ISFT Intelligent motor starting panel controller

The fully programmable ISFT Intelligent motoring starting controller has been designed for demanding motor starting applications with the following features:

ISFT Controller Features	
Power circuit interface	Complete and versatile control interface to a three leg, six thyristor reduced voltage soft starter power assembly and its protection circuits.
Four isolated control inputs	Four universal connection 24 VDC, galvanically isolated control inputs.
Eight isolated bit outputs	Eight galvanically isolated transistor bit outputs.
Four relay outputs	Four 5A contact relay outputs.
Input and output parameters	Fully programmable parameters and function for each input and output.
Voltage and current analog output	Fully programmable galvanically isolated analog voltage and current output.
Pt100 probe interface	External Pt100 temperature interface.
Fault and warning parameters	Fully programmable and versatile fault and warning parameters.
True RMS measurement	True RMS measurement of each phase voltage and current.
Thermal current calculation	Thermal current calculation is in real time .
Line frequency and phase monitor	The line is measured and monitored for frequency, phase sequence and integrity.
Network integration	Complete integration within a Quamatic (p. 91), Modbus or other supervisory network systems.
Standard panel dimensions	Standard front panel cut-out dimensions (per DIN 43700).
Operation	Simple, self-contained, unattended operation by non-specialist personnel.

ISFT front panel

Typical applications for the ISFT are:

- Control of high inertia loads such as large fans and crushers,
- Control of high static friction loads such as material transport mechanisms, and
- High availability, fully protected loads such as in waterworks pumping stations.

All ISFT parameters are programmable and user-configurable. The ISFT controls the voltage supply to the motor load under the following variables:

ISFT Control of Voltage Supply to the Load	
Acceleration profile	Current limited linear or boosted torque acceleration profile.
Acceleration start	Voltage value at acceleration start.
Acceleration duration	Specifies the duration of the acceleration ramp.
"Kick" profile	“Kick” pulse is specified in voltage value and timing.
Deceleration duration	Specifies the duration of the decelerating ramp.
Deceleration timing	Voltage value at deceleration start and stop.
Operation times	Minimum on/off, fault recovery and operation times

The controller features a versatile two tier error handling system. Warning/alarm and fault conditions are configured individually for each controller variable and external event. Each warning/alarm and fault flag can be individually enabled and configurable in terms of trigger limit and delay.

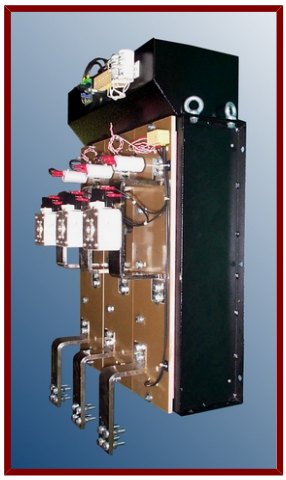
The ISFT interfaces to local and remote devices via its individually configurable input, output, relay and network ports in an extremely flexible and versatile manner:

ISFT Interface to Local and Remote Devices	
Inputs	Each input is of universal connection 24 VDC type and enables, disables, starts or stops motor operation.
Pt100 probe interface	The Pt100 probe interface allows for monitoring overheating or freezing conditions further expanding the available control facilities and options.
Bit and relay outputs	Each bit and relay output can be configured to represent a function of a controller variable or logical flag. Such a flag can be an operational state (e.g. acceleration), a warning/alarm, a fault or a combination of these.
Analog output	The analog output is a voltage and current signal. The magnitude is configurable in terms of offset, scale and signal source. In this way the chosen internal variable is replicated at the analog output.
Serial port	The network port is a dual standard serial type: EIA(RS)232 for local communications and/or EIA(RS)485 for connection to Quamatic (p. 91), Modbus and similar networks and/or remote sensors.

The interface to the thyristor assembly is efficient and effective:

- The six thyristor gates are driven individually and directly (no other device is needed), and
- The four configurable bit inputs interface to the assembly's fault, event and other signals.

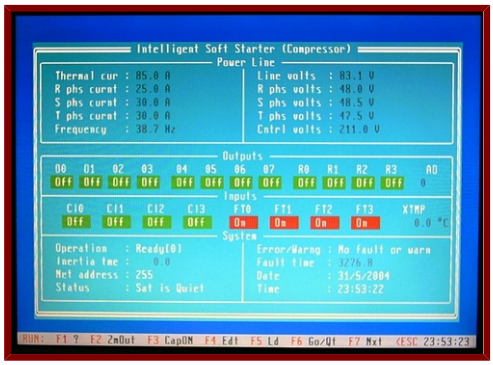
(Low- and medium-voltage thyristor assemblies are offered separately on a custom, per order basis).



Typical thyristor assembly (offered separately)

The front operator panel consists of a large five digit LED display and four operator switches. It is protected to IP54 and is covered by a polyester membrane. The display is visible through a suitably transparent window and the switches are of the tactile type. The controller is designed to be fixed on the inside of an electrical cabinet door/panel with the operator panel facing outwards through a suitable opening.

All connections are made via removable terminal blocks at the controller top and bottom.



Detailed projection screen of ISFT data.

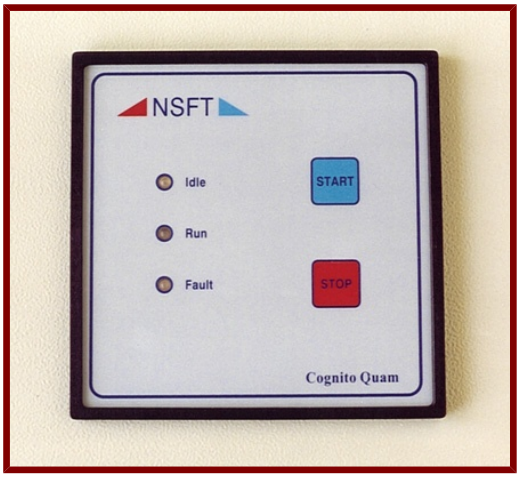
All ISFT parameters can be set or edited locally (via the front panel switches) and/or through the serial port (EIA-RS-232 and EIA-RS-485). The parameters can be set at any time while the controller is powered. In this way the controller operation can be determined dynamically (as in the case of fuzzy control).

The ISFT controller is automatically detected when in a Quamatic (p. 91) or similar network. In this case, all data, parameters, settings etc. are available on-line in hard real time.

Ordering Information	
Model	**Description**
ISFT-16/3	Intelligent motor starter panel controller, 1600 V, 300 mA thyristor drives
ISFT-16/6	Intelligent motor starter panel controller, 1600 V, 600 mA thyristor drives
ISFT-32/3	Intelligent motor starter panel controller, 3200 V, 300 mA thyristor drives
ISFT-32/6	Intelligent motor starter panel controller, 3200 V, 600 mA thyristor drives
XFR400230	Control voltage supply transformer, 90 VA, 400/230 VAC

2.f. NSFT/ICCD Panel Controller in Motor Control

The NSFT/ICCD panel controller has been designed to give local and distributed control capabilities to the NSFTxx soft starter (p. 54).



NSFT/ICCD panel controller

The NSFT/ICCD controller features:

- Standard panel mounting enclosure (DIN 43700) with an IP54 polyester membrane face,
- Two user tactile switches on the front panel,
- Three status indicating LEDs,
- A solid state switch to drive a bypass contactor,
- Comprehensive signal and power connections with the NSFTxx hardware, and
- Quamatic (p. 91) and Modbus network connectivity.

The network capability is offered as an option and turns the controller to a Quamatic (p. 91) or Modbus satellite with the following functions:

NSFT/ICCD Panel Controller Quamatic/Modbus Functions	
Record exchange	Identity, Status, Progress and Configuration
Timestamping	Record Timestamping
Commands	Go and Quiet (Start/Stop)

The four NSFTxx hardware bit state outputs (“Idle-Run-Bypass-Fault”) are repeated, galvanically isolated, for further processing by any local automation devices.

The BAO-1 panel controller and logger (p. 39) can control and manage a number of NSFT/ICCD controllers connected in a Quamatic (p. 91) multidrop network. In such a case, the BAO-1 manages and controls the distributed resources (soft starters and all other types) in typical applications such as plant ventilation and pump station control and monitoring.

Ordering Information	
Model	**Description**
NSFTQ-L	NSFT/ICCD panel controller, local control only.
NSFTQ-N	NSFT/ICCD panel controller, local and network control.

2.g. BAO-1 Panel Controller and Logger in Motion Control Applications

The fully programmable and versatile BAO-1 panel controller and logger has been designed for the distributed process/batch control environment. It combines local and remote control with production logging facilities and manages a Quamatic (p. 91 or similar) network of satellites.

BAO-1 panel controller and logger

Typical applications for the BAO-1 are:

- Large scale drying stations/ovens,
- Plant ventilation control,
- Pumpstation control and monitoring,
- In-line workpiece processing and handling,
- General material transport, handling and logging, and
- Production plant and machinery control.

For a detailed description of the controller see p. 39.

2.h. Jolly Jogger Treadmill Controller

The Jolly Jogger control offers a simple, versatile and comprehensive solution in treadmill applications and is an effective, efficient and popular choice for retrofits. The only external item required to realize a functioning treadmill is the variable speed AC or DC drive with the Jolly Jogger monitoring and controlling all treadmill activity in a safe and vitalizing experience.

Jolly Jogger Treadmill Controller

The Jolly Jogger integrates all the functions expected in a treadmill application:

• Drives the treadmill variable speed AC or DC motor drive,

• Directly controls the slope motor rise and lower movements,

• Estimates or uses the available encoder feedback in measuring treadmill speed and travelled distance,

• Estimates or uses the available slope encoder/potentiometer feedback in measuring slope angle,

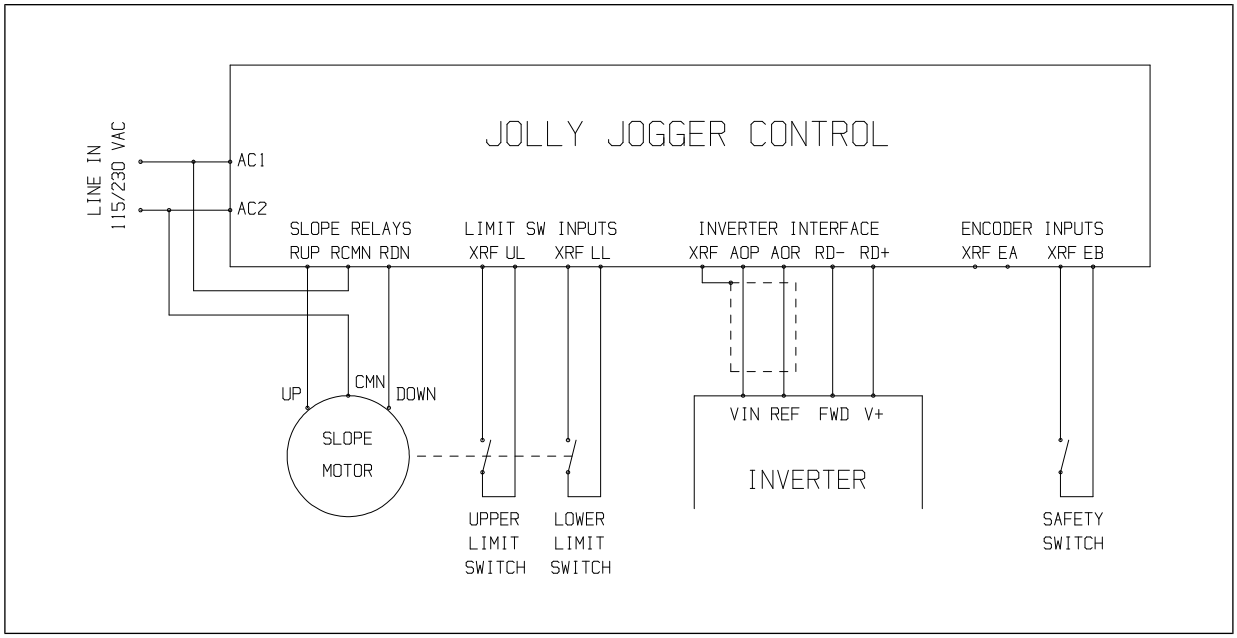
• Incorporates all user safety and operational safeguard procedures, and

• Features a simple, "clean" and attractive user interface with large LED displays and tactile switches.

All aspects of Jolly Jogger operation are set and controlled by configuration parameters kept in non-volatile memory. The parameters are accessible/set via the front panel display and switches or the board's serial port with the provided monitoring/setup software.

The controller is designed for 50-60 Hz supply lines of 115 and 230 VAC and with the following characterizing features:

Jolly Jogger Feature Summary	
Standard drive interface	The speed controller (typically an AC inverter or DC drive) is driven with a 0-10 VDC control signal and an enabling or direction setting optotransistor output which can be connected to both, PNP (active-high, current source) and NPN (active-low, current sink) inputs. Practically any inverter/drive can be used.
Universal slope control	The raising or lowering mechanism is controlled by independent 12 A relays and, as such, can be driven with any, DC or AC, voltage.
24 VDC I/O	The available I/O interface signals are the up/down terminal switch inputs, the speed/slope encoder inputs and the drive enable output. They are all standard 24 VDC types and optoisolated from the internal logic.
Safety switch interface	In the usual case where one of the encoder inputs (typically for the slope) is not used, the associated input can double as a general enable by connecting it to a safety switch.
Dimensions	The anodized alluminium front panel is 2 mm thick and sized 30 x 20 cm (11.8 x 7.9 in). The controller PCB is fixed at its back and with its 249 x 152 mm (9.8 x 6 in) dimensions allows for the assembly to "drop" into a suitably sized hole and be fastened with countersunk screws at the front.



Typical Jolly Jogger connection diagram. The unit is supplied by the line and activates the up/down windings of the slope motor whithin the range defined by the limit switches. The inverter is driven with the analog signal and direction bit while one of the encoder inputs is used under its alternative role as a general enable command.

Ordering information	
Model	**Description**
JJ_115	Jolly Jogger control, 115 VAC supply
JJ_230	Jolly Jogger control, 230 VAC supply

3. PROCESS CONTROL AND AUTOMATION PRODUCTS

3.a. AR1/AR1-H Panel Thermostat/Hygrostat

The AR1 panel thermostat and AR1-H panel hygrostat have been designed for the distributed process control environment with the following user-oriented characteristics:

- Simple, stand-alone, unattended operation by non-specialist personnel,
- Fully, field programmable parameters for each output,
- Complete, “seamless” integration as a slave to an external master or network, and
- Standard panel cut-out dimensions (per DIN 43700).

AR1 panel thermostat

Typical applications for the AR1 and AR1-H are (without any other components):

- Direct control of independent cooling and heating circuits,
- Control of three-way valves,
- Control of single cooling or heating circuit selected by external command signal, and
- Thermostatic control and simultaneously driving alarms (optical or acoustic) or defrosting devices.

Both controllers use a common hardware platform with the following resources:

AR1 and AR1-H Resources	
Pt100 3-conductor input	Compensates the effect of practically unlimited cable length.
2 solid-state 230 VAC outputs	The outputs directly drive solenoids, contactors, vanes, heaters and actuators with integral cycle, low noise AC voltage.
12-bit A/D	Fast conversion and running average processing.
4 optoisolated bit inputs	These inputs offer versatile local control capabilities.
Serial port	Local EIA(RS)232 and network EIA(RS)485 connection.
Display	4-digit-plus-sign LED display.
Front panel	IP54 protected polyester membrane 4 tactile switches.

The AR1 panel thermostat is parametrically programmable for each output in the following:

AR1 and AR1-H Programmable Parameters	
Output functions	The output can be “Always ON”, “Always OFF”, “Heat”, “Cool”, “Time” and “Period”. The “Time” and “Period” functions are very effective in implementing timing tasks such as defrosting and self-cleaning cycles.
Reference temperature	Specifies the reference point for the heating and cooling functions.
Reference hysteresis	Specifies the activation and de-activation points above and below the temperature reference.
Inertia duration	Inertia duration to maintain the output state for a minimum time following a change (typically used to limit the number of starts/stops per hour in pump applications).
Turn On/Off times or duration	Specify the turn-on and turn-off time or duration for the “Time” and “Period” functions.
Output PWM	Output PWM mark/space duration. Each output on-state can be a PWM signal of programmable mark/space duration (typically to drive alarms and visual/audible warnings).
Logic complement of each output	Each output can be logically active-low or active-high, enabling the use of all types of actuators (e.g. normally-open and normally-closed valves).
Autorun enable	Enables the unattended, automatic start of operation.
Parameter edit enable	Enables the alteration of programmed parameters by the operator.
Ignore operator enable	Ignores all front panel commands, typically for remote, unattended operation.
Serial port	Serial port baud rate and net address.
Display index	Defines the magnitude/state to be displayed from the panel front.

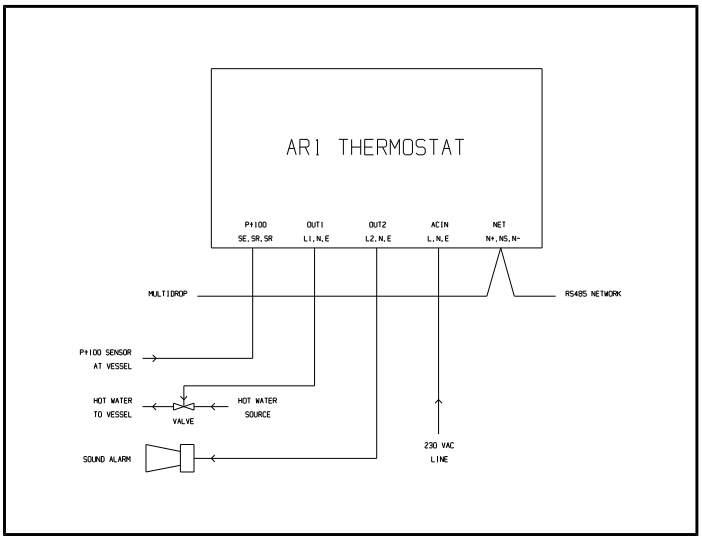
The AR1-H panel hygrostat uses our humidity sensors (p.69) and in addition to the above features offers:

Additional AR1-H Features	
Output functions	“Dry” and “Wet”
Reference limit and hysteresis	Humidity control limit and hysteresis for the “Dry” and “Wet” functions”
Calibration table	Humidity calibration table to convert to user units

All parameters are programmable (separately or in groups) at all times (including during normal operation) via the serial port. This enables the thermostat to be used as a slave to a master which dynamically alters set-points or performs fuzzy control.

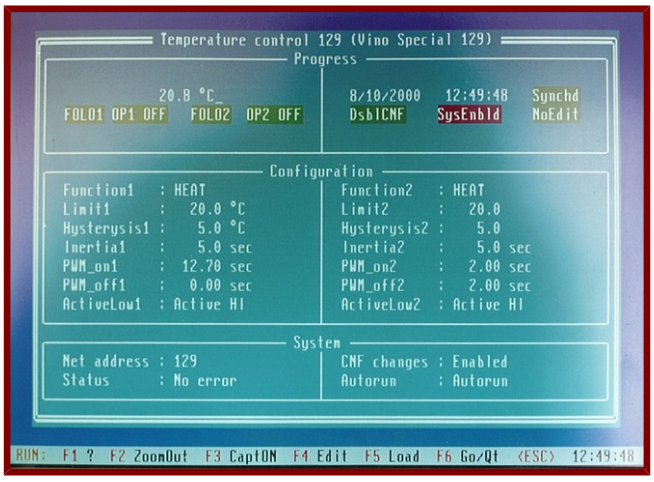
The measured values (temperature and humidity) are the result of internal DSP filtering.

The four bit inputs enable control by local hardware. Each output function can be individually reversed (between “Heat” and “Cool”, “Dry” and “Wet”), parameter changes can be enabled and disable the outputs. (Output disabling is not available at the AR1-H, as the respective input is used for the humidity signal).



Typical AR1 thermostatic application

The AR1 and AR1-H are automatically detected when in a Quamatic network (p. 91). In this case, all its data, parameters, settings etc. are available on-line in hard real time.



Detailed projection screen of AR1 data

Ordering Information	
Model	**Description**
AR1	Panel thermostat
AR1-H	Panel hygrostat and thermostat
HumPt100	Humidity and Pt100 temperature sensor
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

3.b. BAO-1 Panel Controller and Logger

The fully programmable and versatile BAO-1 panel controller and logger has been designed for the distributed process/batch control environment with the following user-oriented characteristics:

BAO-1 Panel Controller and Logger Characteristics	
Operation	Simple, self-contained, unattended operation by non-specialist personnel.
Management and control of remote Quamatic satellite	Complete master mode management and control of remote Quamatic (p. 91) satellites such as a CSNS moisture/humidity sensor, INVD inverter drive or a NSFT/ICCD controller.
Calibration table	Ten point calibration table converts the remote satellite data to user units.
Encoder and material sensor interface	Rotary encoder and material sensor interface monitors processed material length, workpiece count and production time.
Workpiece count, length, duration	Production is logged in two sets: batch and accumulated workpiece count, length and duration.
Isolated bit inputs and outputs	These are general purpose galvanically isolated bit inputs and outputs to interface to local automation devices.
Input and output parameters	The parameters and function for each input and output are fully programmable.
PID controlled analog output	Analog output can also be the result of a variable setpoint and PID parameter calculation.
Running average	Running average filtering of all measured variables.
Network integration	Complete integration within a Quamatic (p. 91) or Modbus network or other supervisory systems.
Standard enclosure	Standard enclosure and front panel cut-out dimensions (per DIN 43700).

BAO-1 Panel Controller and Logger

Typical applications for the BAO-1 are:

- Large scale drying stations/ovens,
- Plant ventilation control,
- Pumpstation control and monitoring,
- In-line workpiece processing and handling,
- General material transport, handling and logging, and
- Production plant and machinery control.

The controller is automatically detected when in a Quamatic network (p. 91). In this case, all its data, parameters, settings etc. are available on-line in hard real time.

The controller features the following hardware resources:

BAO-1 Controller and Logger Resources	
Encoder and material sensor interface	Four galvanically isolated fast bit inputs interface to a rotary encoder and material sensor to detect and measure machine speed, processed material length and count.
Isolated bit inputs	Eight galvanically isolated, DSP filtered bit inputs to interface to external events and states.
Isolated bit outputs	Eight galvanically isolated bit outputs to drive and signal local automation circuits.
Serial communications	Dual standard serial communication port: EIA(RS)232 for local communications and/or EIA(RS)485 for connection to Quamatic (p. 91), Modbus or similar networks and remote sensors.
Three isolated supply potentials	Triple isolated output power supply to the unit's circuits: EIA(RS)485 net port, internal logic and external interface.
Front panel	Five digit-plus-sign LED display and four operator switches.

The front panel is protected to IP54 and is covered by a polyester membrane. The digits are visible through a contrast enhancing transparent window and the switches are of the tactile type.

All parameters are programmable (separately or in groups) at all times while the controller is powered. In this way the controller operation can be determined dynamically (as in the case of fuzzy control). The controller is parametrically programmable for the following:

BAO-1 Controller Programmable Parameters	
Bit output function	Each output can be a logical function of a bit input, other bit output, an internal logical state, the result of a value comparison or function to an internal variable (e.g. encoder speed, workpiece count, position etc.). The activated state timing is also programmable (wait delay, duration, or PWM repetition). The timing can be specified in terms of workpiece position thus allowing for speed independent material processing.
Variable display units	Individually programmable display units for the batch and accumulated count, length and duration variables.
Encoder prescaler	Encoder prescaler and length conversion multiplier to define the internal units and accuracy of position measurement and control.
Running average samples	Number of running average samples to effectively and efficiently filter the measured data.
Network parameters	All network parameters ensuring reliable and optimum communication traffic with the network members.
Operation flags	Operation flags (autorun/manual, enable/disable editing, displayed variable etc.) adapt to the exact requirements of the specific application.
Analog output function	The analog output can be a replica of an internal variable or the PID control result to a setpoint value of any internal variable (e.g. encoder speed, remote data etc.).

Ordering Information	
Model	**Description**
BAO-1	12+8 bit I/O and analog output panel controller and logger
CSNS	Capacitive sensor and controller
INVDxx	INVD AC motor inverter drives
NSFTQ-N	NSFT/ICCD panel controller, local and network control
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

3.c. SSRAC Solid State Relay Analog Controller

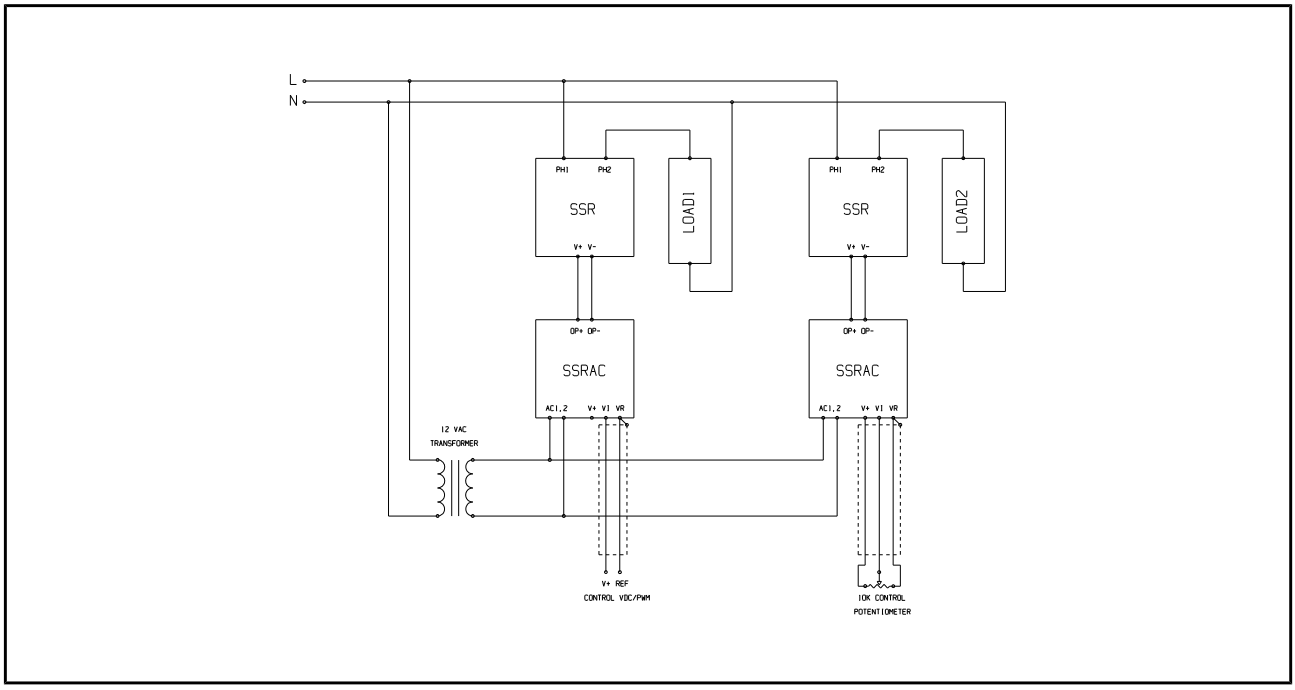
The SSRAC controller

Our fully protected solid state relay analog controller interface accepts a 0 - 10 VDC, PWM or potentiometer signal to drive a solid state relay (SSR) in AC load phase control applications such as:

- PLC controlled light dimming,
- Potentiometer controlled heater, and
- Small motor load soft starting.

It is powered and synchronized to the line by the low voltage AC input and connects directly without any other components to the SSR and control input source.

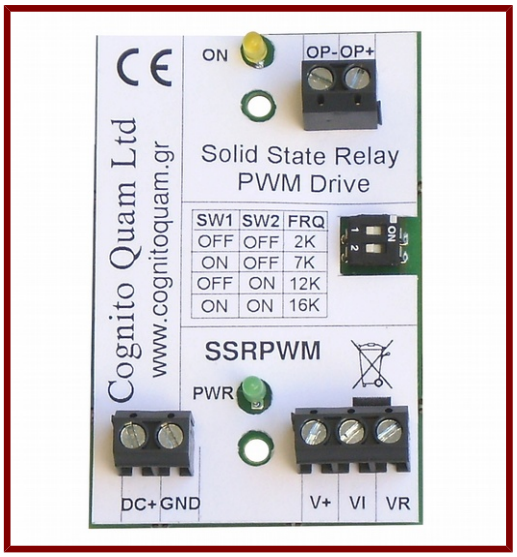
It is mounted above the SSR with accompanying 50 mm spacers and screws. (The spacers are also used to fix the SSR at the mounting face).



Typical connection diagram

Ordering Information	
Model	**Description**
SSRAC	Solid state relay analog controller

3.d. PWM Solid State Relay (SSR) Drive



The PWM SSR Drive

Our fully protected PWM (Pulse Width Modulation) solid state relay drive interface accepts an analog 0 – 10 VDC, PWM or potentiometer signal to drive a DC solid state relay in control applications such as:

• PLC controlled LED light dimming,

• Potentiometer controlled thermal loads, and

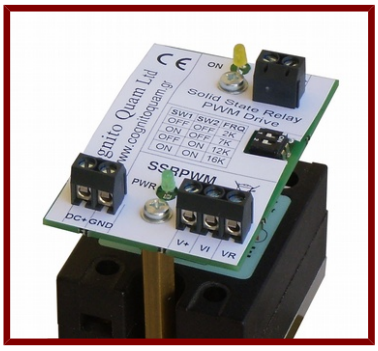
• DC load control such as motors, actuators and solenoids.

The controller is powered with 10-28 VDC and is connected directly without any other components to the SSR and control input source. The PWM frequency is set at the on board DIP switch and different ranges are offered as options:

• Low frequency range (30, 75, 150, 200 Hz) addressing lighting and heating applications,

• Mid frequency range (125, 350, 600, 800 Hz) addressing general and actuator applications, and

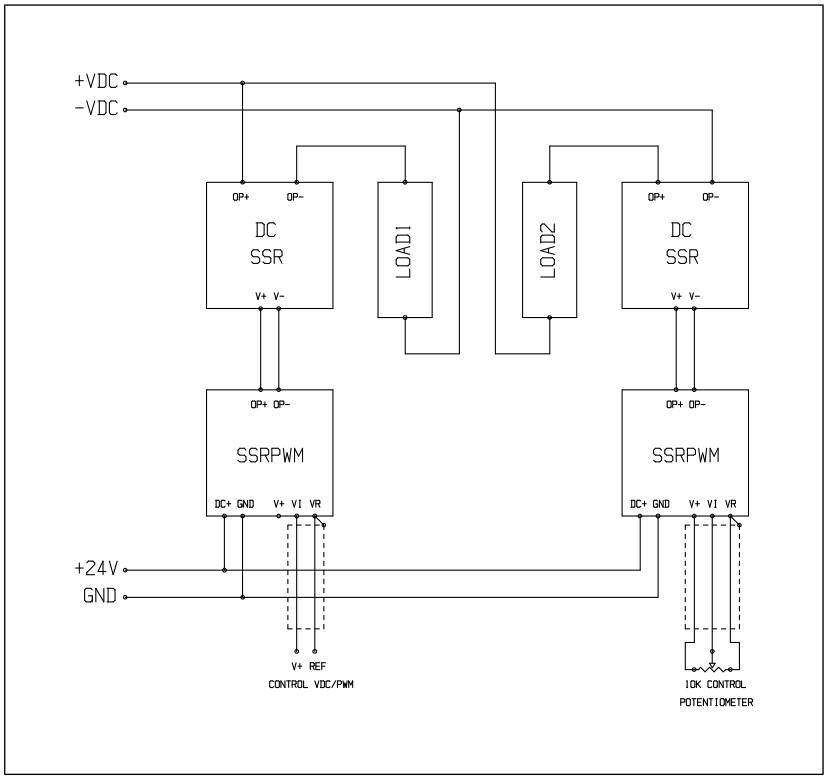
• High frequency range (2K, 7K, 12K, 16K Hz) addressing magnetic load, motor and solenoid applications.



The controller is mounted above the SSR with accompanying 50 mm spacers and screws. (The spacers are also used to fix the SSR at the mounting face).

The SSRPWM is designed for standard DC line systems. The characterizing features are as follows:

SSRPWM Feature Summary	
Power supply	10-28 VDC power supply is protected against line noise and disturbances.
Analog input protection	Analog/potentiometer input is protected against reverse polarity connection, shorts and out-of-range potentials.
SSR drive output	Current limited SSR drive handles all SSR input problems.
LEDs	Indicating LEDs show power supply and SSR drive state.

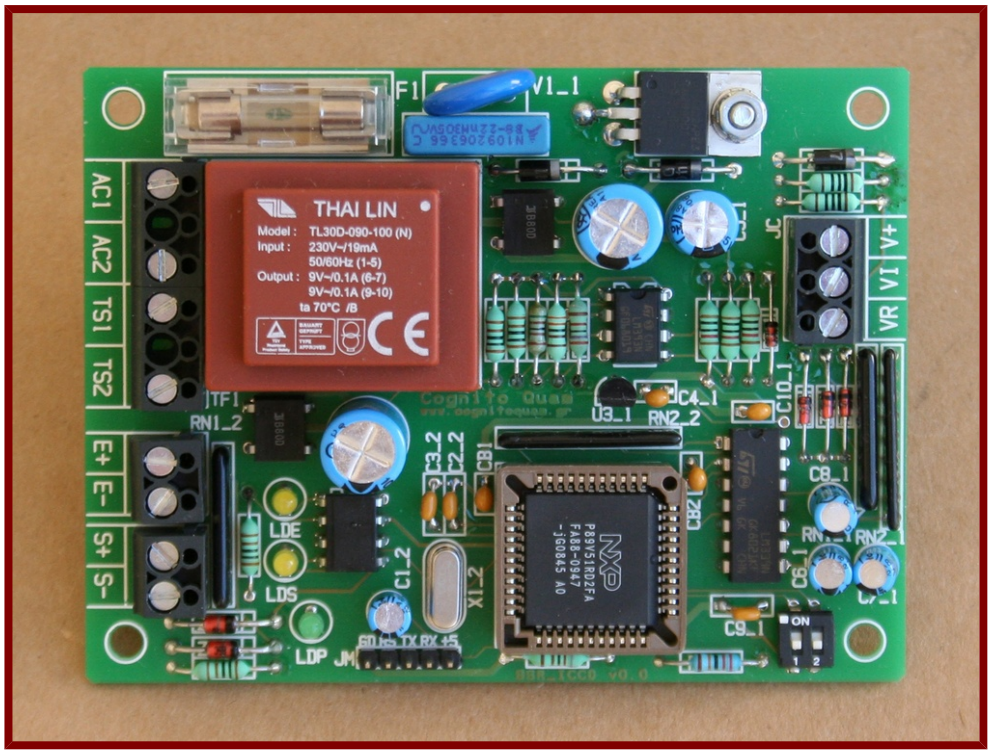


Typical SSRPWM connections. The unit on the left is controlled by a 0-10 VDC source and drives a PNP (current source) load. The one on the right is controlled by a 10 K potentiometer and drives a NPN (current sink) load. Both are powered by the 24 VDC line. The V+ input is not used when an analog signal controls the unit.

Ordering information	
Model	**Description**
SSRPWM_L	Low frequency (30, 75, 150, 200 Hz) solid state relay PWM drive
SSRPWM_M	Medium frequency (125, 350, 600, 800 Hz) solid state relay PWM drive
SSRPWM_H	High frequency (2, 7, 12, 16 KHz) solid state relay PWM drive

3.e. SSR_ICCD Solid State Relay (SSR) Integral Cycle Control Drive

The SSR_ICCD accepts a 0–5 VDC, PWM or potentiometer signal to drive the target SSR with complete (integral) line half-cycles minimizing supply and load line disturbances and noise. SSR_ICCD operation is enabled by two dedicated inputs, one interfacing to general function enabling dry contacts and the other to a thermal cut-out device. The enabling logic type (positive or negative) and the averaging period during which the on/off integral cycle sequence is proportional to the analog input signal are set at the board DIP switch.

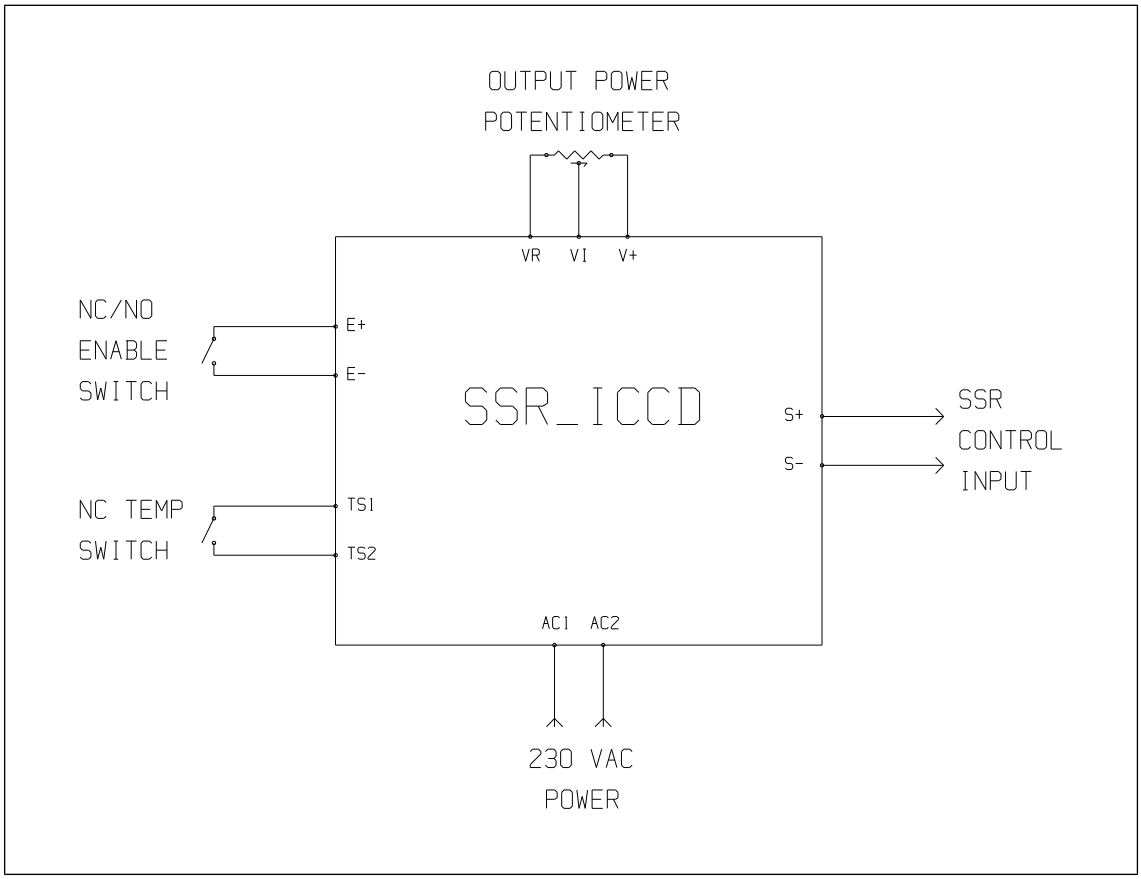


The SSR_ICCD board

The SSR_ICCD is designed for standard single- and three- phase line systems. The characterizing features are as follows:

SSR_ICCD Feature Summary	
Power supply	230 VAC power supply is protected against line noise and disturbances.
Temperature switch input	Normally closed temperature switch is internally wired to cut-out board AC power. The switch can be used in sensing SSR or load overheating conditions.
Enable input logic	Set at the DIP switch ensuring versatile external control (positive, ON-for-ON or negative, ON-for-OFF).
SSR drive output	Current limited SSR drive handles SSR input problems.
Analog input protection	Analog/potentiometer input is protected against reverse polarity connection, shorts and out-of-range potentials.
Output accumulation time	DIP switch selectable averaging/accumulating time of 25 and 50 line cycles offers 2% and 1% output power resolution respectively.
SSR drive integral cycle	Output ON/OFF half-cycle sequence is proportional to the analog input and synchronized to AC power supply zero-crossings.
Low voltage detection	Low voltage detecting circuit keeps SSR drive off during power-downs and brown-outs.
LEDs	Indicating LEDs show system state.
Isolated I/O circuits	Isolated control and analog circuits enhance safety and noise immunity.

While powered and enabled, the SSR_ICCD reads the analog input and ouputs a sequence of ON half-cycles which are synchronized to its AC supply. The number of ON half-cycles in the accumulating sequence and, as a result, the power conducted by the SSR to the load is proportional to the analog input.



Typical potentiometer controlled SSR_ICCD system. The unit is powered by 230 VAC and enabled by the normally-closed temperature switch and the enable dry contacts. The SSR is driven with a line synchronized ON/OFF integral cycle sequence which is proportional to the potentiometer setting. The V+ connection is not used in the case of an analog 0-5 VDC signal controlling the unit.

Ordering information	
Model	**Description**
SSR_ICCD_230	Solid state relay integral cycle control drive, 1x230 vac line

3.f. 4 channel QSS solid state relay

The 4 channel QSS solid state relay isolates and converts four NPN, active low inputs to activate respective 3 Arms solid state relay (SSR) outputs.

It is powered by 230 VAC and the SSR terminals feature their own isolated line connections making it suitable for applications where the line systems are different or control and power lines are isolated.

Ordering Information	
Model	**Description**
QSS_4_230	4 Channel QSS solid state relay, 1x230 VAC.

3.g. NSFT/ICCD Panel Controller in Thermal Load Control

The NSFT/ICCD panel controller has been designed to give local and distributed control capabilities to the ICCDxx thermal load drives (p. 59).

NSFT/ICCD panel controller

The NSFT/ICCD controller features:

- Standard panel mounting enclosure (DIN 43700) with an IP54 polyester membrane face,
- Two user tactile switches on the front panel,
- Three status indicating LEDs,
- A solid state switch to drive a bypass contactor,
- Comprehensive signal and power connections with the ICCDxx hardware, and
- Quamatic (p. 91) and Modbus network connectivity.

The network capability is offered as an option and turns the controller to a Quamatic (p. 91) or Modbus satellite with the following functions:

NSFT/ICCD Panel Controller Quamatic/Modbus Functions	
Record Exchange	Identity, Status, Progress and Configuration
Timestamping	Record Timestamping
Commands	Go and Quiet (Start/Stop)

The four ICCDxx hardware bit state outputs (“Idle-Run-Bypass-Fault”/”Idle-Run-Load Fault-Fault”) are repeated, galvanically isolated, for further processing by any local automation devices.

The BAO-1 panel controller and logger (p. 39) can control and manage a number of NSFT/ICCD controllers connected in a Quamatic multidrop network (p. 91). In such a case, the BAO-1 manages and controls the distributed resources (soft starters and all other types) in typical applications such as plant ventilation and pump station control and monitoring.

When used with the ICCDxx, the controller extends the available power resolution by extending the available PWM integration period without introducing any further subharmonic disturbances to the line.

Ordering Information	
Model	**Description**
NSFTQ-L	NSFT/ICCD panel controller, local control only.
NSFTQ-N	NSFT/ICCD panel controller, local and network control.

3.h. A8 Field Configurable Panel Controller

Our A8 panel controller is designed for the process control environment with the following user-oriented characteristics:

- Simple stand-alone, unattended operation by non-specialist personnel,
- Fully, field programmable parameters and transfer function/equation for each output,
- Complete, “seamless” integration as a slave to an external master, and
- Standard DIN43700 panel cut-out dimensions.

Panel controller front view.

The controller features the following resources:

A8 Panel Controller Resources	
8 channel A/D	12-bit, with optionally 1 mA excited inputs.
8 bit outputs	Optoisolated, programmable function
3 bit inputs	Optoisolated, programmable function
Serial port	EIA(RS)232 type serial port.
LED display	4-digit-plus-sign display.
Front panel	Polyester membrane, IP54 protection with two tactile switches.
CMOS memory	32k battery backed-up CMOS memory

The controller is parametrically programmable for the following:

A8 Panel Controller Parameters	
Bit output transfer function	The output state can be a function of the analogue inputs, the bit inputs and outputs.
Bit output PWM mark/space duration	Each output on-state can be a PWM signal of programmable mark/space duration.
Analog input calibration tables	Each analog input can be transformed via its own calibration table.
Display index	Defines the magnitude/state to be displayed on the front panel.
Display legends	Text to display each bit input and output state.

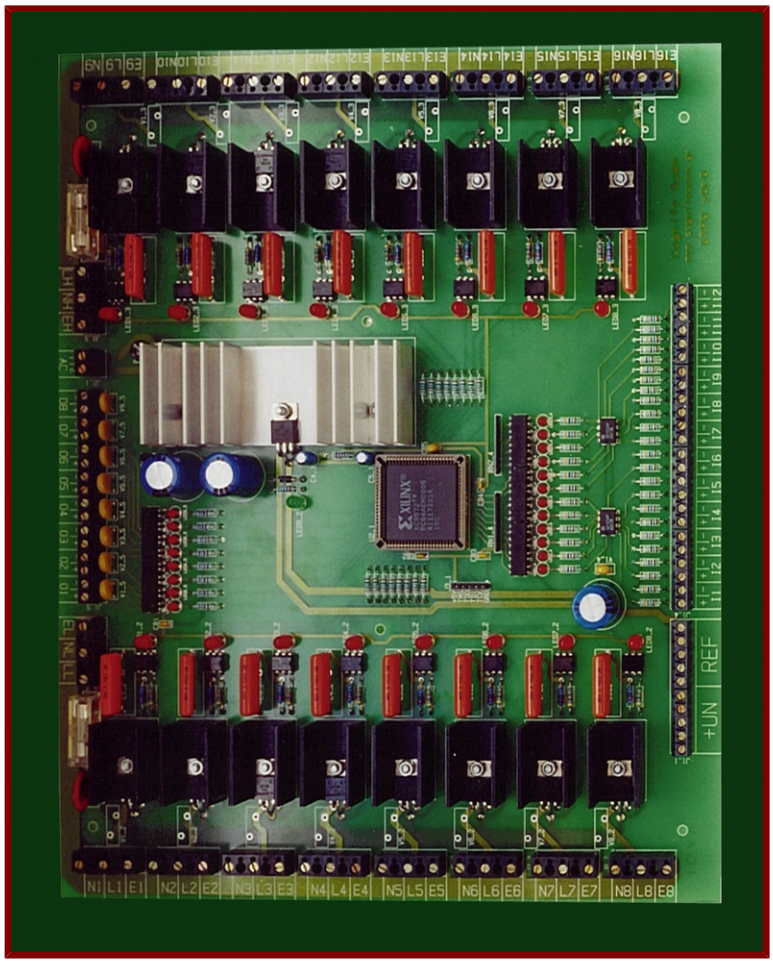
All parameters are programmable (separately or in groups) at all times (including during normal operation) via the serial port. This enables the controller to be used as a slave to a master which dynamically alters set-points or performs fuzzy control.

The controller comes with all the necessary software including a simulator for the off-line development of the system transfer functions.

Ordering Information	
Model	**Description**
A8	A8 field configurable panel controller
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

3.i. Fire protection/Fire damper UTP Controller

Effective fire protection calls for the hierarchical determination of each function of the covered area under all conditions. With this in mind, the UTP controller follows the typical fire protection cycle of “system preparation” to “normal function” to “alarm condition” to “area clearing” and back to “system preparation”.



Fire protection/Fire damper UTP controller

The UTP controller drives two galvanically isolated groups of 8 loads each with 24 - 230 VAC TRIAC (solid-state) switches. Typical loads are fire damper actuators/motors, warning lamps, contactors etc. The outputs switch on in synchronization with the AC supply to minimize turn-on (in-rush) currents, load stress and generated noise.

The controller interfaces to external systems with its fully protected 12 bit inputs and 8 bit outputs. The outputs are galvanically isolated NPN optotransistors and the inputs are NPN sinks at the controller potential.

The controller can also supply local devices (such as sensors) with unregulated 15 VDC.

Ordering Information	
Model	**Description**
UTP	Fire protection/fire damper UTP controller
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

4. POWER ELECTRONICS PRODUCTS

4.a. INVDxx AC Motor Inverter Drives

INVD20 inverter drive

The INVDxx inverter drives interface with most (if not all) automation equipment in the market as well as all Quamatic hardware (p. 91). They are versatile mechanical interfaces in many applications and are fully protected, network-ready, digitally-controlled, fully-programmable units. They are simple to install and are effectively employed in speed control applications driving:

- Transport systems (conveyors, escalators, roller tables etc.),
- Pumps and compressors,
- Transmissions (gear trains, high-ratio belt systems etc.),
- Fans and ventilators, and
- Mixers.

Main features of the line include:

INVDxx Features	
Standard range	3phase, 5 - 40 HP (3.7 - 30 kW), 400-440 VAC nominal power capability. Models below 5HP and above 40HP are available on special request.
Four model types	Basic, Analogue, PLL and All options.
Controlled inrush current	Soft starting DC-link charge-up to minimize capacitor inrush currents.
Full protection	Fully protected, robust operation.
Output filter	Output dV/dt filter to protect the load, its insulation and to minimize noise.
Control input and output interface	Versatile, multimode isolated universal connection 24 VDC control input and output interface.
Serial port	Dual standard serial port (EIA-232 and EIA-485).
Parameter programmability	Full parameter programmability via the serial port.
Power supply	Local unregulated supply (24 VDC) to power the control interface, small sensors, solid-state relays and other small automation devices.
Brake kit	Optional resistor brake kit.
Control connectors	Easily accessible power and removable control connectors.
Change of rotational direction	On the fly change of rotational direction.

The four types in each power category are:

- "Basic": Controlled remotely via the serial port and locally by the three multimode bit inputs. User programmable control modes include "direction-up-down", "preset speed select" and "direction-enable-disable". The fault output is always valid and the configuration and operation parameters are programmable via the serial port only. The front carries three LEDs indicating the "ready", "run" and "fault" states.

- "Analog": This is a "Basic" superset with the addition of an isolated analog input stage for local speed control by potentiometer or analog signal.

- "PLL": This a "Basic" superset with the addition of Phase Locked Loop speed control (a novelty for AC induction motor speed control as far as we know) or open loop frequency control.

- "All options": This is the fully featured type which includes the features of all the above types and offers local programmability and control via its 5-digit LED display and 4 tactile switch operator panel.

Multi-motor applications are very easy to implement. Any number of INVDs can be connected in a EIA(RS)485 network and controlled by a BAO-1 panel controller (p. 39) or other network master, all individually programmable by the supplied PC software. Using the frequency control feature enables the network to follow a master encoder or other similar device with minimal hardware. When the PLL feature is employed with local encoder feedback each unit can drive the motor speed under PID control with no other devices needed.

Inverter operation is determined by the programmable parameters and is controlled locally via the control input/output interface and remotely via the serial port. All models have full parameter programmability via the serial port and all changes are immediately effective. The available parameter groups are:

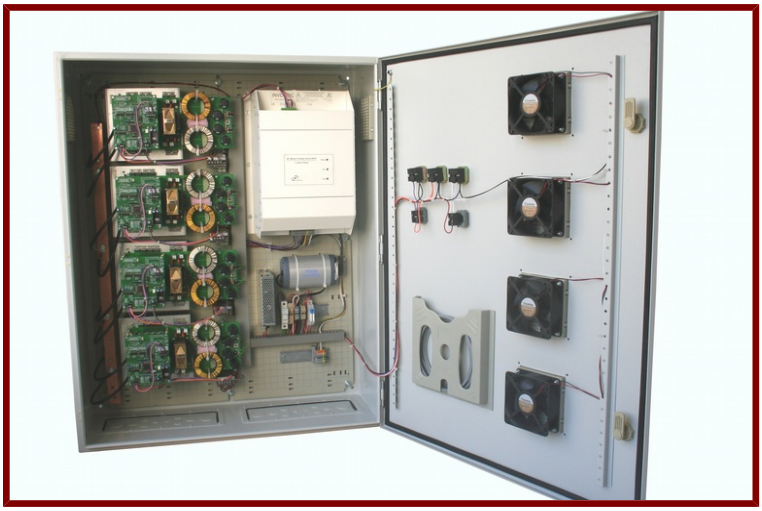
- Serial communications (network address, baud, time-outs),
- Operation (control type, acceleration/deceleration values, individual feature activation, start/stop timing, pre-set output values, fault handling), and
- Output waveform characteristics (voltage and frequency offset and slope, PWM frequency).

Protections are individually programmable and enabled. These include:

- Internal temperature due to cooling circuit or other hardware failure,
- Upper and lower line voltage (valid range is 330 - 470 VAC), and
- Individual IGBT switch overcurrent, protecting against all fault types (line-to-line, line-to-earth, DC-link short).

The accompanying PC software tool can be used in setting up and operating the inverter drive.

The INVD can be powered via its DC bus in custom arrangements such as this on the right. Four parallel-in, series-out connected 24/173 V DC/DC converters generate the 6 KVA, 690 VDC bus needed by the INVD to drive a 3x480 VAC motor load from a 24 VDC source.



Ordering information (Standard power capacities: 5/4, 7/5, 10/7, 15/11, 20/15, 25/18, 30/22, and 40/30 HP/kW. 'xx' in ordering code below to be replaced with required HP rating)	
Model	**Description**
INVDxxAB	xx HP analog input inverter drive with brake
INVDxxAN	xx HP analog input inverter drive
INVDxxBB	xx HP basic inverter drive with brake
INVDxxBN	xx HP basic inverter drive
INVDxxFB	xx HP full inverter drive control with all options, panel control and brake
INVDxxFN	xx HP full inverter drive control with all options and panel control
INVDxxPB	xx HP PLL inverter drive with brake
INVDxxPN	xx HP PLL inverter drive
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

4.b. NSFTxx Line of Soft Starters

NSFT25 25HP (37A/phase) soft starter.

NSFTxx soft starters accelerate and decelerate AC induction motor loads smoothly, save energy and reduce system wear and tear.

They interface with most (if not all) automation equipment in the market and are an effective mechanical interface in many applications. They are all fully protected, digitally controlled, programmable units. They are simple to install and are effectively employed in driving:

- Transport systems (conveyors, escalators, roller tables etc.) for low inertia loads,
- Pumps and compressors,
- Inelastic transmissions (gear trains, high-ratio belt systems etc.), and
- Fans and ventilators.

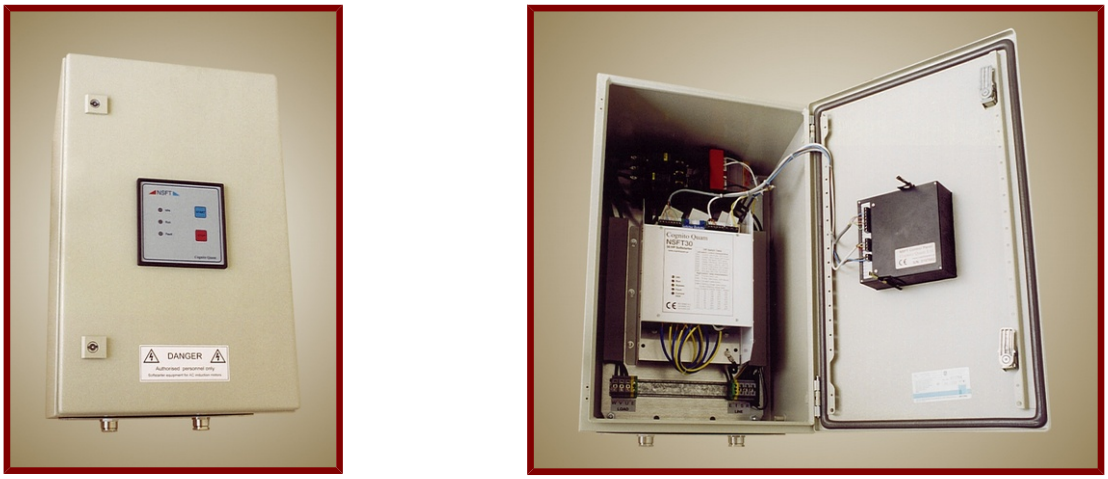
Main features of the line include:

NSFTxx Features	
Power circuit	Generous x4 starting current and cooling circuit design provides for 60-555 A (starting, per phase), 10-90 HP/7.5-66 kW (at 3x400 VAC) loads. The employed 1600 VDC power circuit allows use in up to 3x480 VAC systems.
Torque control	User selectable cycle-by-cycle starting current limitation.
Complete, electronic protection	Overcurrent, undercurrent, overvoltage, undervoltage, against noise, faults and disturbances in the supply, phase sequence and integrity, internal temperature.
Control interface	Galvanically isolated, versatile two input user/control interface.
Analog interface	One load current output and one overcurrent limit input.
DIP switch selectable parameters	Operation timer, fault handling, trigger/control type, profile, starting control, protection type, deceleration, starting value and duration options.
Isolated control outputs	Galvanically isolated “Idle”, “Run”, “By-pass”, “Fault” outputs.
Power supply	Small 24 VDC power supply available to power a local sensor or other automation device.
“Bookcase” enclosure	Installation-friendly, space-saving “bookcase”, robust enclosure.
Seperate control circuit supply	Enables seperate/isolated power circuit functions and prevents any power disruptions from affecting the unit’s control and monitoring functions.

When combined with a NSFT/ICCD panel controller (p. 32), the NSFTxx operates under network and/or local control.

Characterizing Features of the NSFTxx Line					
Model	**Motor power, Delta connected, HP/kW**	**Motor power, Inside Delta connected, HP/kW**	**Maximum starting current, A**	**Motoring phase current, A**	**Worst case motoring heat dissipation (no bypass), W**
NSFT10	10/7.5	17/12.5	60	15	61
NSFT15	15/11	26/19	100	23	95
NSFT20	20/15	35/25	135	30	109
NSFT25	25/18.5	43/32	165	37	138
NSFT30	30/22	52/38	190	45	150
NSFT35	35/26	60/44	210	52	174
NSFT40	40/30	69/51	235	60	202
NSFT45	45/33	78/57	300	67	218
NSFT50	50/37	86/63	330	75	252
NSFT55	55/40	95/70	360	82	275
NSFT60	60/44	103/76	377	91	306
NSFT75	75/55	129/95	470	114	345
NSFT90	90/66	155/114	555	137	414

The line is also available in ready-to-install, completely assembled systems. Units over 10HP include a bypass contactor to minimize heat dissipation.



Ready-to-install soft-starter system.

Features are:

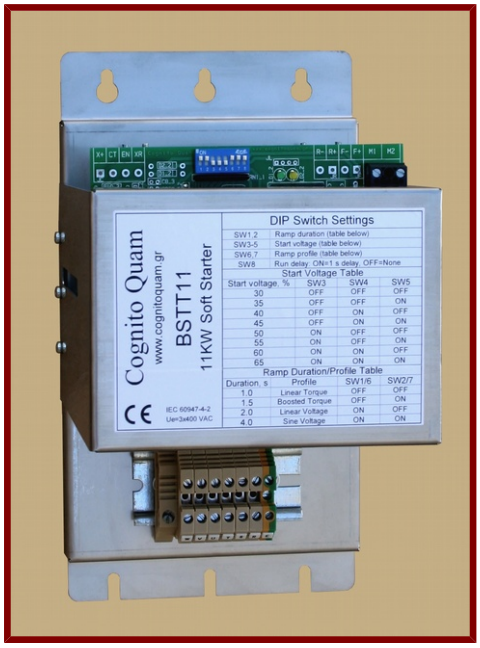
Ready-to-Install System Features	
Wall-mounted cabinet	The IP54 electrical wall-mounted cabinet for use in an environment of <50°C.
NSFT/ICCD Panel Controller	The front NSFT/ICCD panel controller (p. 47) integrates all the required automation and is a practical and robust user interface. Quamatic (p. 91) or Modbus connectivity is offered as an option.
Bypass contactor	The bypass contactor is driven by the panel controller solid-state switch.
400/230 V transformer	A 400/230 V transformer sources the required 230 V control voltage thus eliminating the need to connect to the line neutral.
DIN rail terminal blocks	Line and load connections are made to DIN rail terminal blocks.

Units above 90 HP and for non-standard/medium voltage applications are produced on a per order, custom base.

Ordering Information	
Model	**Description**
NSFTxx	xx HP standard soft starter
NSFTxx-SL	xx HP ready soft starter system, local control only.
NSFTxx-SN	xx HP ready soft starter system, local and network control.
NSFTQ-L	NSFT/ICCD panel controller, local control only.
NSFTQ-N	NSFT/ICCD panel controller, local and network control.
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

4.c. BSFT and BSTT Basic AC Induction Motor Soft starters

The BSxT soft starters accelerate and decelerate (BSFT only) simple AC induction motor loads smoothly, save energy and reduce system wear and tear.

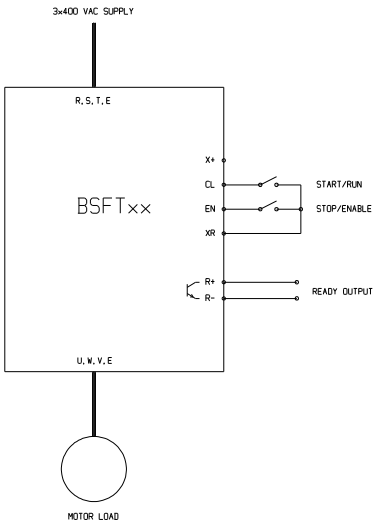


BSTT 11KW soft starter

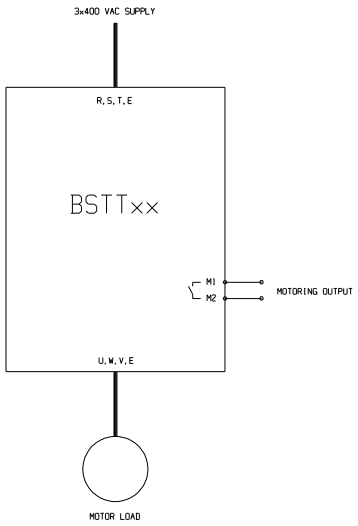
They are all partly protected, digitally-controlled and programmable units. They are simple to install and are effectively employed in low cost applications driving:

- Transport systems (conveyors, escalators, roller tables etc.) for low inertia loads,
- Pumps and compressors,
- Hydraulic lift pumps,
- Inelastic transmissions (gear trains, high-ratio belt systems etc.), and
- Fans and ventilators.

BSxT Features	
Power circuit	Starting current and cooling circuit design provides for 55-75 A (starting, per phase), 13-16 HP/10-12 kW loads. The employed 1200 VDC power circuit allows use in up to 3x430 VAC systems.
Integrated bypass relay	Internal relay bypasses the solid state switches to minimize losses.
Electronic protection	Overvoltage, undervoltage, against noise, faults and disturbances in the supply, phase sequence and integrity, internal temperature.
Control method	BSFT is controlled via two, “Run” and “Enable”, galvanically isolated inputs, BSTT is activated after power-up.
Ramp profiles	Linear torque, boosted torque, linear voltage (BSTT only), sine voltage (BSTT only).
DIP switch selectable parameters	Ramp profile, deceleration (BSFT only), starting value (30-65 %), ramp duration (1-4 s) and activation delay.
Isolated control output	Galvanically isolated “Ready” (BSFT) or “Motoring” (BSTT).
Power supply	Small 24 VDC power supply available to power a local sensor or other automation device.
“Bookcase” enclosure	Installation-friendly, space-saving “bookcase”, robust enclosure.
Self-powered from the 3x400 VAC line	Control circuit is powered from the 3x400 VAC line.



Typical BSFTxx connection



Typical BSTTxx connection

Characterizing Features of the BSFT and BSTT Models at 3x400 VAC					
Model	**Motor power, Delta connected, HP/kW**	**Motor power, Inside Delta connected, HP/kW**	**Maximum starting current, A**	**Motoring phase current, A**	**Maximum number of starts/hour**
BSFT10	14/10	24/17	55	19	Unlimited
BSTT11	15/11	26/19	55	22	60
BSFT12	16/12	27/20	75	25	Unlimited

Ordering Information	
Model	**Description**
BSFT10	10 KW basic soft start-stop
BSFT12	12 KW basic soft start-stop
BSTT11	11 KW basic soft start

4.d. ICCDxx Integral Cycle Thermal Load Drive

ICCD60 integral cycle control drive

The ICCDxx line employs thyristor switches to drive thermal loads with complete cycles minimizing supply and load line disturbances and noise.

They interface with most (if not all) hardware as well as most automation equipment in the market and are an effective thermal load interface in many applications. They are all fully protected, digitally-controlled and programmable units.

They are simple to install and are effectively employed in applications driving:

- All types of resistive and inductive heaters,
- Ovens, and
- Boilers.

The characteristics of the line are:

ICCDxx Characteristics at 3x400 VAC			
Model	**Power, kVA**	**Current, A/phase**	**Maximum heat dissipation, W**
ICCD15	10	15	61
ICCD30	20	30	109
ICCD45	30	45	150
ICCD60	40	60	202
ICCD75	50	75	252

Main features of the line include:

ICCDxx Features	
Low noise integral cycle thyristor control	Complete cycles only are conducted to the load, thus eliminating all di/dt and dV/dt caused interference.
Power circuit	3-phase, 15-75 A/phase. The employed 1600 VDC power circuit allows use in up to 3x480 VAC systems.
All types of load connection	Drives both, Wye/Star and Mesh/Delta connected loads.
Complete electronic protection	Overcurrent, undercurrent, overvoltage, undervoltage, against noise, faults and disturbances in the supply, phase integrity, internal temperature.
Interface	Versatile two input user/control interface.
Galvanically isolated bit outputs	“Idle”, “Run”, “Load Fault”, “Fault”.
Small power supply 24 VDC	Available to power a local sensor or other automation device.
Enclosure	Installation-friendly, robust, space-saving “bookcase” style.

The NSFT/ICCD panel controller accessory (p. 47) enables the ICCDxx to operate in a Quamatic (p. 91) or Modbus network as well as extending its control range.

Units above 75 A are produced on a per order, custom base.

Ordering Information	
Model	**Description**
ICCD15	15 A/phase integral cycle control drive for thermal loads
ICCD30	30 A/phase integral cycle control drive for thermal loads
ICCD45	45 A/phase integral cycle control drive for thermal loads
ICCD60	60 A/phase integral cycle control drive for thermal loads
ICCD75	75 A/phase integral cycle control drive for thermal loads
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

4.e. Mistral Ventilation Control

The Mistral ventilation fan controller is a typical IMOD (p. 62) application.

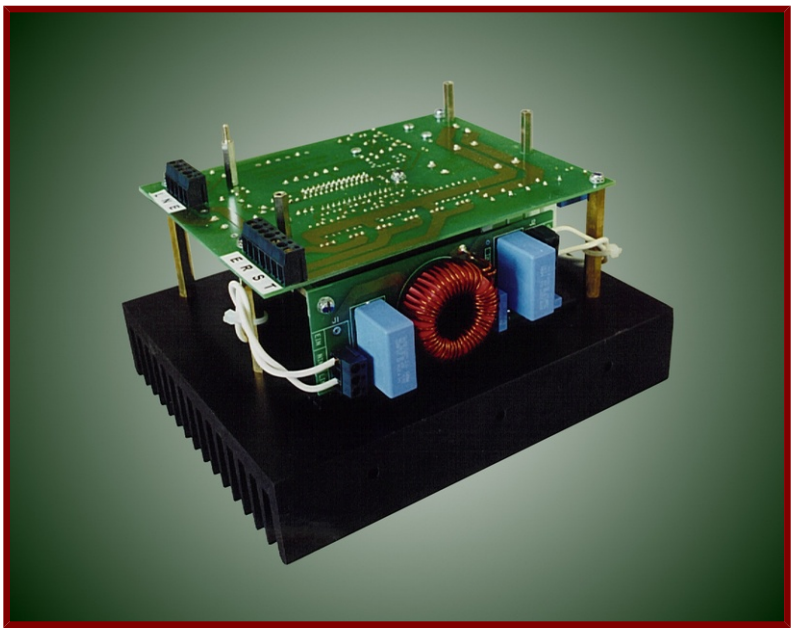
Mistral 2HP fan controller incorporating an IMOD module.

The Mistral fan control requires no setting up and features a very simple user interface and IP54 packaging.

With its ergonomic and waterproof polyester membrane front panel and passive heat dissipation system, it is ideally suited for the catering and professional kitchen environment.

Ordering Information	
Model	**Description**
Mistral2	2 HP ventilation fan control

4.f. IMOD Inverter Module



IMOD as supplied to OEM customers.

Our fully-protected inverter OEM module is designed for maximum adaptability to the original product requirements.

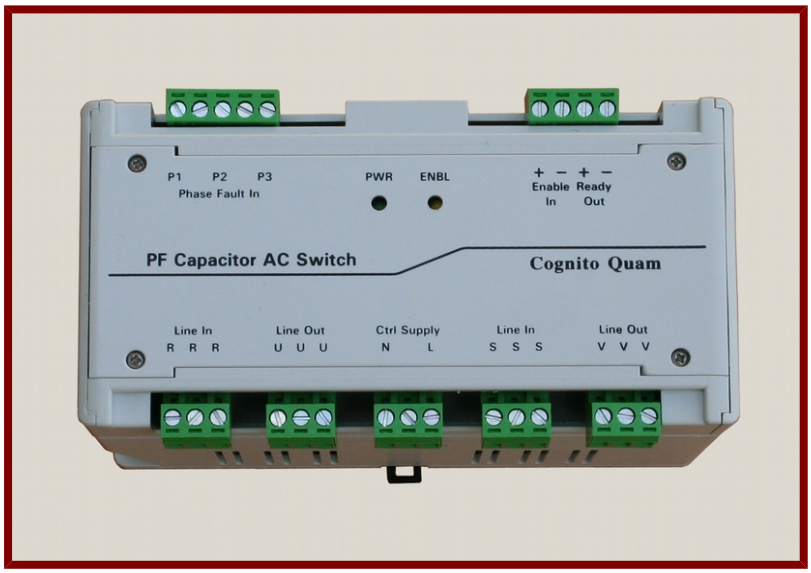
The module features a large heatsink (no fan required) and a versatile control interface to drive a 2 HP motor at low power factors.

The controlling board can be attached on the available supports and can use all the available fault conditions (overcurrent and overtemperature), DC link voltage and current signals and power supply voltages.

Ordering Information	
Model	**Description**
IMOD2	2 HP inverter module

4.g. CACSW Integrated Power Factor Capacitor AC Switch

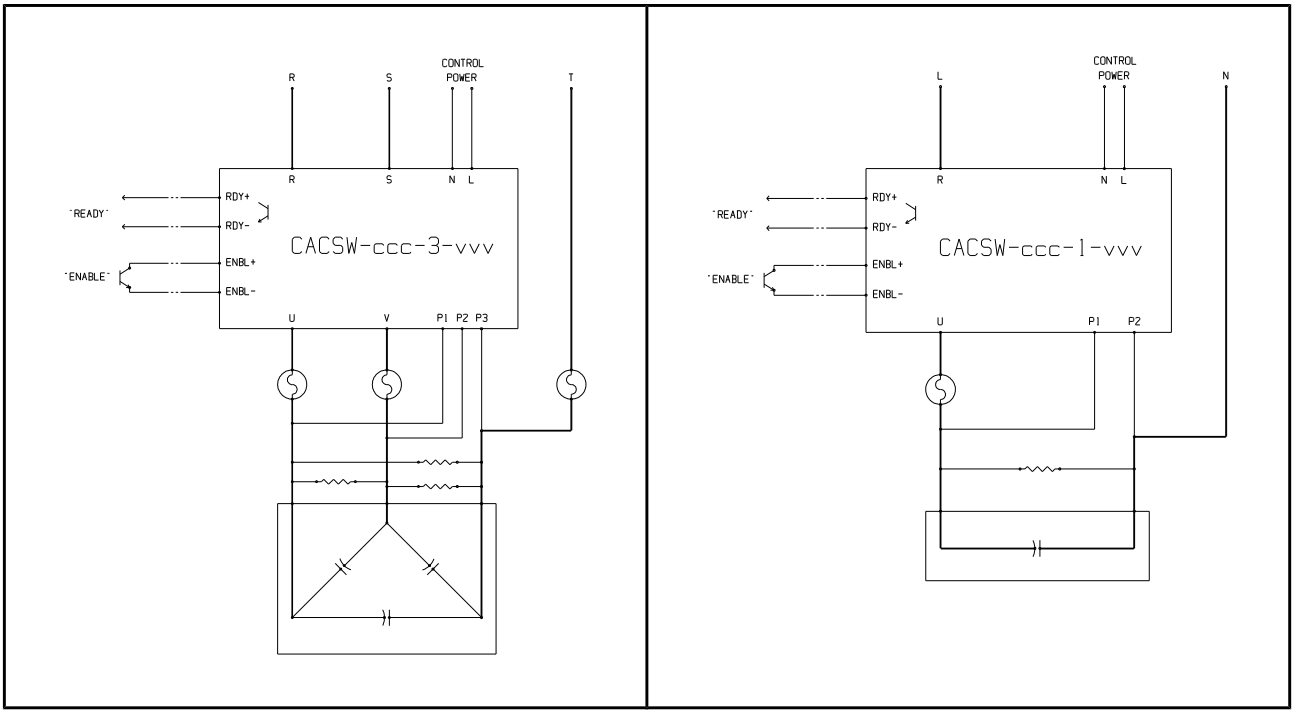
The CACSW connects a single- or three- phase 25 A power factor capacitor bank to the line, employing bypassed, zero crossing, solid state thyristor switches. Its phase fault detector can be used to either monitor the line for phase integrity or the capacitor bank circuit for fuse state as well as line faults.



The CACSW PF capacitor AC switch

The CACSW solid state thyristor switches connect to the capacitor bank at zero voltage difference without any disturbing inrush currents. They are then bypassed by a relay to eliminate all thyristor conduction losses and are protected against overheating, typically caused by failure of the relay contacts. The control input is digitally filtered to reject noise and the unit responds within a maximum time of 2.5 seconds.

CACSW Feature Summary	
Line connection	Powered by the line, without any connection to the neutral.
Own control supply	Powered separately at the control supply terminals.
Overheat protected solid state relays	Solid state relays circuits switch the 25 A compensating capacitors in and out of the line at every sampling instant.
Zero crossing type solid state relays	Each capacitor is switched in when the line voltage equals the capacitor voltage thus eliminating capacitor inrush current and extending capacitor service life.
Switch bypass relay	Bypass relay across each solid state switch minimizes/eliminates switch losses.
Sampling time	Minimum 1 second sampling time gives a maximum 2.5 s response time.
Phase fault detector	The switch is monitored for phase faults and/or blown fuses.
Stand-alone or slave operation	DIP switch selectable slave mode allows stand-alone or external master control.
Forced state	DIP switch forced state turns the switch on regardless of control input state.
Indicating LEDs	LEDs show the power supply state ("PWR", green) and the switch activation status ("ENBL", yellow). The "PWR" LED flashes on a detected phase fault (or blown fuse) while the "ENBL" flashes on thyristor switch overheating.
Isolated control circuit	Control circuit is galvanically isolated enhancing safety and noise immunity.
Protection	Against line overvoltages, faults and power circuit overheating.
DIN rail enclosure	Versatile DIN rail mountable plastic box.
Removable terminal blocks	Removable terminal blocks ensure quick and neat wiring Installation.



Typical CACSW system switching a three-phase (left) and single-phase (right) capacitor in and out of the line. The capacitor is protected by a fuse in each live phase with the CACSW detecting their state at the P1, P2, P3 inputs. The bleed resistors can be any convenient value as the capacitor is connected at zero voltage difference with the line and no special discharge timing applies. The switch is activated at the ENBL control input and its status is reported by the RDY output. Control power may be directly obtained from the line or from a separate control/instrumenation line. The high capacitor current path is shown in bold.

Ordering Information by Line System and Control Supply Voltage (Not shown combinations are available on a custom order basis)					
Description	**Single phase 110-130 V, 50-60 Hz lines**	**Single phase 220-240 V, 50-60 Hz lines**	**Three-phase 3x220-240 V, 50-60 Hz lines**	**Three-phase 3x400 V, 50-60 Hz lines**	**Three-phase 3x480 V, 50-60 Hz lines**
Power factor capacitor AC switch, 110-130 VAC supply	CACSW-115-1-115		CACSW-115-3-230		CACSW-115-3-480
Power factor capacitor AC switch, 220-240 VAC supply		CACSW-230-1-230	CACSW-230-3-230	CACSW-230-3-400	CACSW-230-3-480
Power factor capacitor AC switch, 400 VAC supply				CACSW-400-3-400	
Power factor capacitor AC switch, 480 VAC supply					CACSW-480-3-480

4.h. VBR-1 Vibrating actuator control

The VBR-1 drives vibrating actuators with variable excitation at two preset frequencies. Typical applications include controlling bowl feeders, sieves and all types of large and small material handlers. Excitation is controlled by potentiometer at the VBR-1 face while power is switched by the rocker switch at its side.

VBR-1 Vibrating actuator control

The VBR-1 offers two excitation frequencies: at the line frequency and at half the line frequency enabling the control of all, large and small, material sizes.

The VBR-1 is designed to drive all standard vibrating actuators. The characterizing features are as follows:

- Up to 3 A drive current,
- Selectable excitation frequency is set at installation via the on-board DIP switch inside,
- Isolated control circuit enhances safety and noise immunity,
- Protection against line overvoltages, faults and overload, and
- Versatile plastic enclosure with IP65 cable glands.

Ordering Information	
Model	**Description**
VBR-1	Vibrating actuator control

4.i. DEFOG Heater element

The DEFOG heater element is attached to the back of a mirror or similar surface to stop water vapour condensing in humid environments.

Mirror defogging element

The element is designed for bathroom/shower room duty with the following characterizing features:

- Powered by 12 V safety sources for zone 1, 2 and 3 duty (per IEC 60364-7-701 standard).
- Very thin, under 1 mm thick, can be used practically in all demisting applications.
- Made with very strong and durable FR4 flame-retardant laminate and printed circuit technology.
- Can be placed side-by-side and connected in parallel to cover surfaces of any size and shape.
- Very simple and easy to install.

Ordering Information	
Model	**Description**
DEFOG 20W12	Mirror defogging element, 20 W, 12 V, 305 x 250 mm
DEFOG 30W12	Mirror defogging element, 30 W, 12 V, 305 x 500 mm

5. TEST, MEASUREMENT, SIGNAL INTERFACING AND CONVERSION PRODUCTS

5.a. PFCDxx-xxx Power Factor Current Detector

The PFCDxx-xxx power factor current detector measures the apparent and either the active or reactive current in a single- or three- phase power line to respectively produce a set of two 10 VDC analog signals. The two outputs can then be used by a PLC or other controlling device to calculate line power factor as well as monitor the applicable active or reactive current characteristics. It is very simple to install and adaptable to all power factor compensation applications.

Power Factor Current Detector PFCD1R

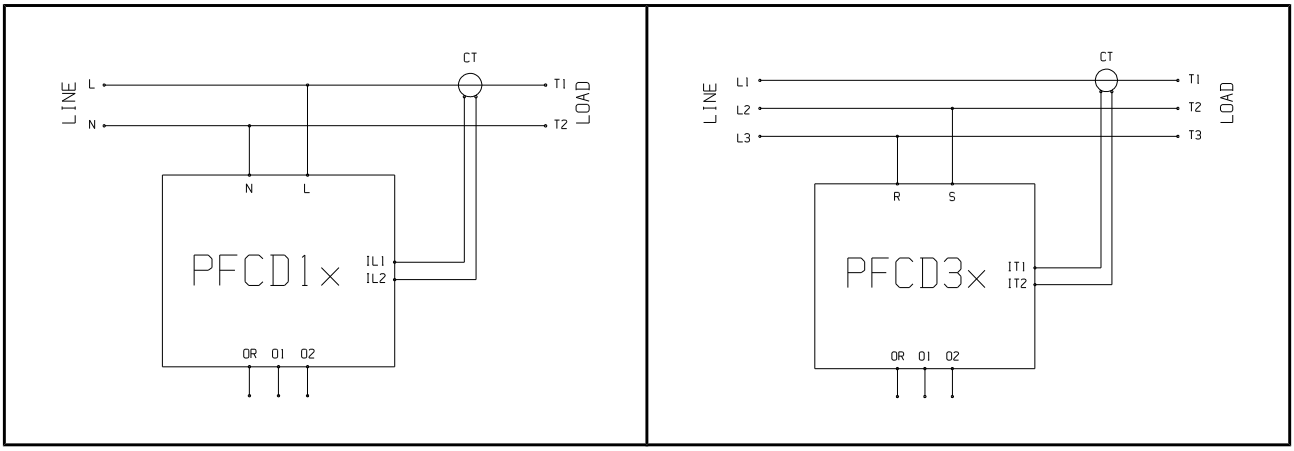
The PFCD measures the power factor related currents in a single-phase (PFCD1x-xxx models) or three-phase (PFCD3x-xxx models) system and produces a unipolar 0-10 VDC signal representing the apparent current and a bipolar ±10 VDC signal representing the active (PFCDxA-xxx models) or reactive (PFCDxR-xxx models) current. The current is picked up with a current transformer (CT) in one of the phase lines with a response time of about 3 seconds.

The PFCD's versatility and fast response make it particularly suitable for integrating into systems such as:

- Power factor measurement and compensation,
- Power factor and energy flow measurement,
- Reactive current measurement and compensation, and
- Line current measurement and overload/underload protection.

The PFCD is designed for single-phase (PFCD1x-xxx models) or three-phase (PFCD3x-xxx models) lines. Characterizing features are shown in the following table.

PFCDxx Characteristics	
Line connection	The PFCD connects to two of the three-phase lines and no connection is needed to the neutral for the three-phase version (PFCD3x-xxx models).
Current detection	By standard 5 A secondary current transformer.
Phase sensitive detection	The active or reactive current is measured without being affected by noise and harmonics in the line.
Analog outputs	Analog outputs can drive loads with up to 10 mA.
Indicating LEDs	LEDs show the power supply state and the existence of capacitive current in the monitored line or an inversely connected CT.
Isolated control circuit	Isolated control circuit enhances safety and noise immunity.
Protection	Protection against line overvoltages and faults.



Connection diagram of a PFCD1x-xxx to a single-phase line (left) and PFCD3x-xxx to a three-phase line (right).

Ordering Information by Line Voltage					
Description	**120 V, 60 Hz lines**	**230 V, 50 Hz lines**	**240 V, 60 Hz lines**	**400 V, 50 Hz lines**	**480 V, 60 Hz lines**
PF active current detector, single-phase	PFCD1A-120	PFCD1A-230	PFCD1A-240		
PF reactive current detector, single-phase	PFCD1R-120	PFCD1R-230	PFCD1R-240		
PF active current detector, three-phase	PFCD3A-120		PFCD3A-240	PFCD3A-400	PFCD3A-480
PF reactive current detector, three-phase	PFCD3R-120		PFCD3R-240	PFCD3R-400	PFCD3R-480

5.b. Humidity Sensors for the Processing Industry

Humidity and Pt100 temperature sensor

In-line humidity sensor with CSNS controller (p. 70)

Our humidity/moisture sensors address the problem of measuring humidity in-line production and without interfering chemically, physically or mechanically with the processes taking place. Their origins are in a nineties FAIR project (IMPROLIVE, EU funded) involving the processing of olive oil production wastes.

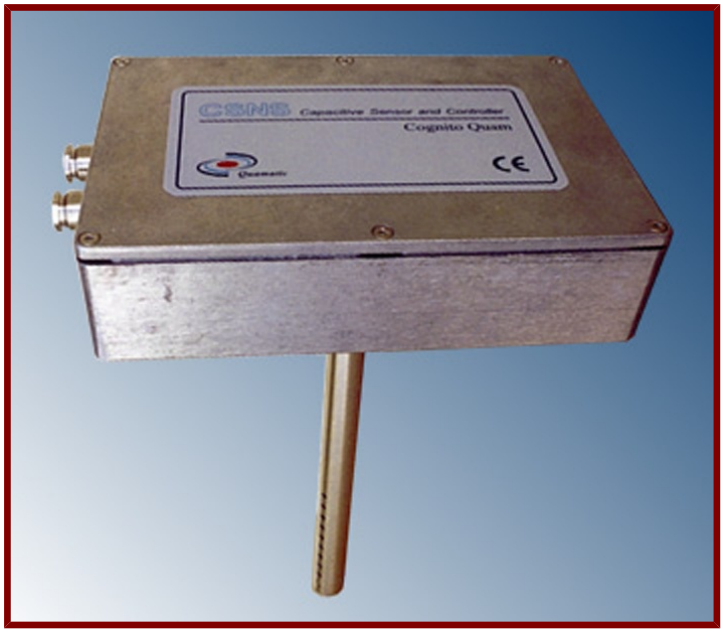
The features of this technology are:

Humidity Sensor Technology Features	
Robust, no moving parts, inert	Being based on the capacitive principle, our sensor is robust, has no moving parts and is chemically, physically and mechanically inert.
Sensor shape	Detecting capacitance does not react in any way with the monitored process, so the sensor can be of any physical shape.
State of monitored mass	The absolute quantity of water in the monitored mass is detected, which can be in any substance, form or phase.
Electronics	The specialist electronics are part of the sensor.

Ordering Information	
Model	**Description**
HumPt100	Humidity and Pt100 temperature sensor
AR1-H	Panel hygrostat and thermostat
CSNS	Capacitive sensor and controller
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

5.c. CSNS Humidity/Moisture Sensor and Controller

The CSNS sensor and controller combines sensing in remote locations with local control functions.



CSNS humidity/moisture sensor and controller

The CSNS sensor and controller features the following resources:

CSNS Sensor and Controller Features	
Isolated capacitance measurement	The sensor capacitance is measured in galvanic isolation to all other CSNS circuits. This enhances noise immunity and protects from adverse external conditions.
Two configurable multifunction analog ports	The sensor and controller features two configurable multifunction analog ports for voltage, potentiometer or 2-wire/3-wire Pt100 temperature element input.
Isolated Bit I/O	Two configurable galvanically isolated 24 VDC universal connection single bit inputs and two configurable galvanically isolated single bit outputs.
Serial communications port	Dual standard serial communication port: EIA(RS)232 for local communications and/or galvanically isolated EIA(RS)485 for connection to Quamatic (p. 91 or similar) networks.
Dual voltage power supply	Dual 230/115 VAC power supply for worldwide application.
IP65 enclosure	The CSNS sensor and controller is housed in an aluminum cast enclosure protected to IP65.

The CSNS sensor and controller firmware allows for:

- Simple, self-contained, unattended operation by non-specialist personnel,
- Fully programmable, locally or via a Quamatic (p. 91) or Modbus network, parameters and functions for each port, input and output,
- Five point calibration table to convert the internal humidity reading to user units,
- Compensation functions for temperature dependencies, series capacitance and similar effects,
- Complete integration within a Quamatic network (automatically detected) or other supervisory systems.

The BAO-1 panel controller (p. 39) is a suitable master mode displaying device to monitor one or more CSNSs in a network.

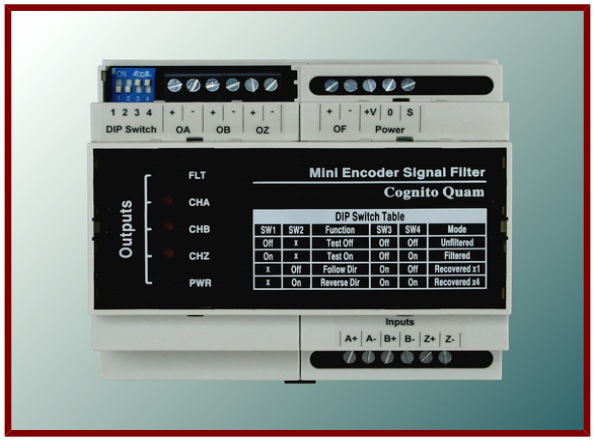
CSNS based in-line moisture sensor measuring olive oil production waste (left) where the sensor body is offered on a custom, per order basis and CSNS based beehive activity monitor (above).

Ordering Information	
Model	**Description**
CSNS	Capacitive sensor and controller
BAO-1	12+8 bit I/O and analog output panel controller
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

5.d. Multimode Encoder Signal Filters

The encoder, in rotary or linear form, is the most popular motion/position sensor and these filters complement, safeguard, maintain and extend their capabilities and performance.

Terminator multimode encoder signal filter



Mini multimode encoder signal filter

The filters remove all types of electrical noise (common and differential mode, dV/dt transients, ground loop generated etc.) in the encoder signal lines as well as the corrupting effects of mechanical noise and vibration (phantom movement, dither etc.). The filters reconstruct the encoder signals to reflect the correct encoder position and speed signaling. Performance is safeguarded and problems such as:

- Motion system position drift,
- Home reference loss,
- False triggering of the receiving inputs, and
- Receiving input saturation, latch-up or failure

are eliminated.

Their design is characterized by typical industrial application considerations: low ownership costs, standard interfacing, fool-proof installation, transparent operation, results-oriented and all-inclusive design. The filters feature the following operational characteristics:

- They are wired in-line between the encoder and the processing equipment. This minimizes and simplifies wiring, usually one of the most significant costs in an installation,
- They interface in a standard way with the encoder outputs and the processing equipment inputs. This enables installation by a non-specialist as well as widening equipment choice,
- They have no special installation requirements, have small physical dimensions and are transparent in operation, and
- They are readily recyclable and made with lead-free materials for minimal impact to the environment.

Our multimode filters are offered in two standard lines: the fully featured Terminator line and the low cost Mini line. Both are all-in-one, comprehensive, value-for-money products, each device addressing all and any combination of known encoder application issues. They process digital quadrature encoder signals with the following features and characteristics:

Multimode Frequency Averaging Filter Line Features Overview

Feature	Terminator Line	Mini Line
Galvanically isolated input and output stages to interrupt unavoidable system ground loops eliminating related noise as well as protecting the input stage of the driven controller from high voltage transients	5 V/ns minimum dV/dt galvanic barrier immunity.	0.1 V/ns minimum dV/dt galvanic barrier immunity.
Four selectable modes of digital processing: 1. Unfiltered: the outputs are buffered replicas of the inputs, 2. Filtered: the encoder inputs are processed for electronic noise only, 3. Recovered x1: the encoder inputs are processed for electronic noise and analyzed for mechanical position to recover corrupted motion sequences. The outputs are in quadrature format and the mark (or index) channel is processed for electrical noise. 4. Recovered x4: Same as the Recovered x1 mode, but with output resolution quadrupling. The output signals are a clock/direction or an up/down pair at four times the input frequency instead of the quadrature format.	Yes	Yes
Test mode. Depending on the chosen mode and sampling frequency, the filter outputs simulate the function of a 1024 ppr encoder.	Output is 1/64 the chosen sampling frequency.	Output frequency is fixed.
Direction reversal. One of the encoder channels can be complemented to effect a direction reversal, thus saving the rewiring/reconnection of the encoder signals.	Yes	Yes
Supply, signal and worn/faulty encoder indication. Five LEDs indicate the status of the power supply, the three encoder channels and the presence of out-of-sequence signalling, typically caused by a worn or faulty encoder.	Yes	Yes
DIP switch selectable options. All operational parameters are set/reset via DIP switches.	Yes	Yes
Independent, galvanically-isolated fault output. The out-of-sequence condition activates this uncommitted optotransistor output interfacing to external systems.	EF24 model only	Yes
Selectable sampling frequency. The encoder signals are DSP processed at selectable frequencies to interface to slower equipment or tune out problem noise sources in particularly difficult applications.	Yes	Yes
Types of EIA(RS)422 input termination.	Standard DC, AC and none	Standard DC and none
Internal dual voltage 115/230 VAC twin supply. Powers the two internally isolated input and output filter sections and can power the monitored encoder with regulated 5 VDC or unregulated 10/15 VDC.	Yes	No. Power must be supplied to each of the input and output filter sections.
Enclosure	Cast aluminium, high noise immunity, IP65	Plastic, DIN rail mountable, IP40
Available speed grades.	High, Standard and Low	Basic only

5.d.1. The Terminator Line

Terminator multimode encoder signal filter

The Terminator multimode filters are all-in-one, value-for-money products addressing high speed, high noise immunity and high environmental protection requirements.

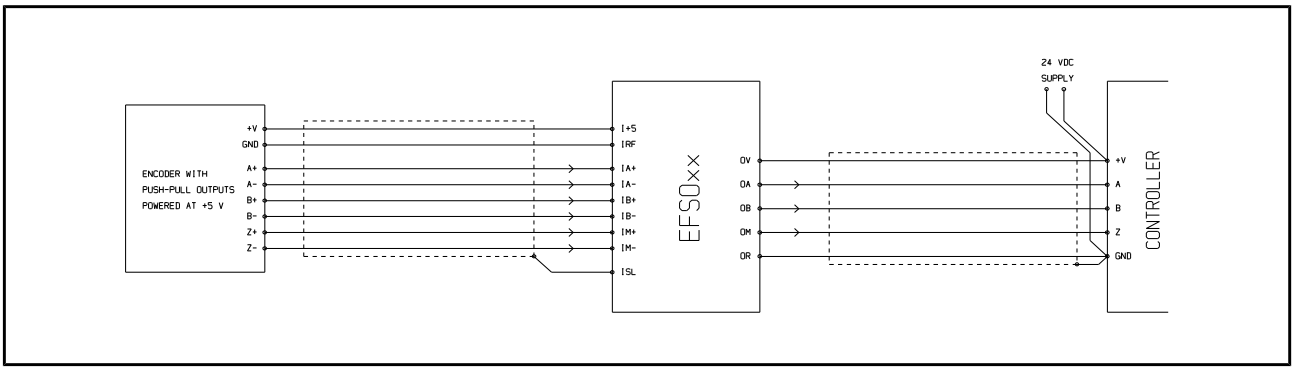
They feature an internal dual voltage 115/230 VAC twin supply which powers the two internally isolated input and output filter sections and can also power the monitored encoder with regulated 5 VDC or unregulated 10/15 VDC.

The line is offered in a range of options which also allow them to be used as interfaces between different encoder and PLC/drive input card signal types. These are:

Terminator Multimode Encoder Filter Model Selection Table					
Model	**Single ended input types**	**Differential input types**	**Universal 5 V output types**	**5-30 V output types**	**Available speed grades**
EF24	All 10-28 V types	10-28 V		All types	Low
EFDO		EIA422	EIA422, all single 5V		High, Standard
EFSO	All 5 V, 5-30 V NPN and push-pull only	EIA422		PNP, push-pull	Low
EFU5	All 5 V, 5-30 V NPN and push-pull only	EIA422	EIA422, all single 5V		High, Standard

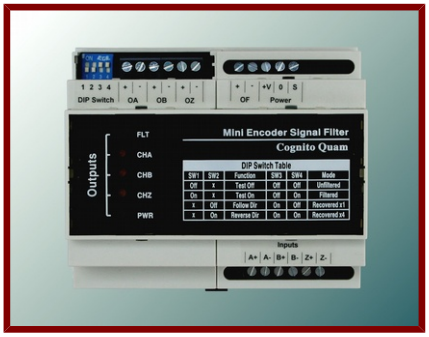
The maximum quadrature input frequency which can be processed by the filters depends on the filter speed grade and function mode as follows:

Maximum Quadrature Input Frequency Capability per Filtering Mode				
Speed Version	**Unfiltered**	**Filtered**	**Recovered x1**	**Recovered x4**
Low	300 kHz	250 kHz	200 kHz	62.5 kHz
Standard	10 MHz	1.5 MHz	1.2 MHz	375 kHz
High	10 MHz	3.0 MHz	2.4 MHz	1.5 MHz



Typical application of a Terminator EFSOxx filter powering a physically remote encoder (connected via long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

5.d.2. The Mini Line



Mini multimode encoder signal filter

The Mini multimode filters are all-in-one, value-for-money products addressing less demanding and low cost needs.

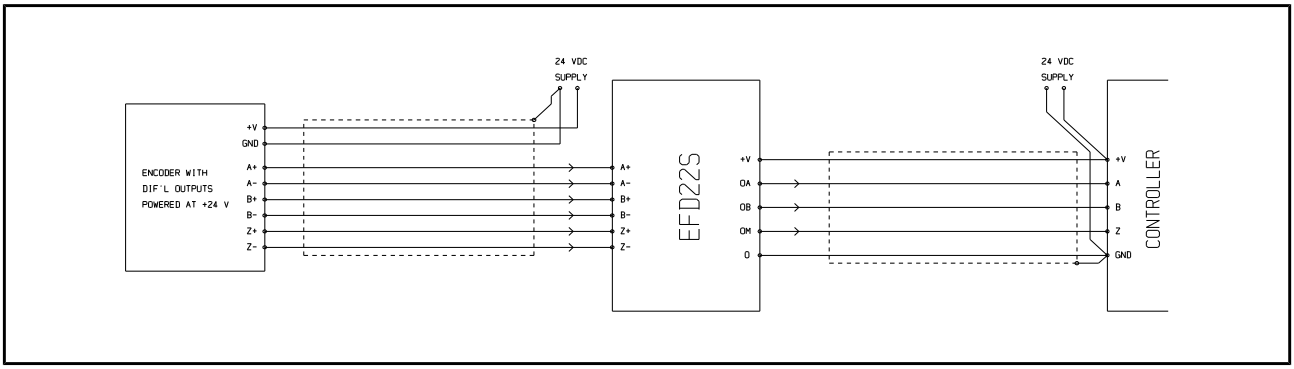
They feature an IP40 DIN rail mountable enclosure and have no internal supply to power the filter input and output sections. The input and output stages are typically powered by the monitored encoder and receiving controller/PLC supplies respectively.

The line is offered in a range of options which also allow them to be used as interfaces between different encoder and PLC/drive input card signal types. These are:

Mini Multimode Encoder Filter Model Selection Table					
Model	**Single ended input types**	**Differential input types**	**Single ended output types**	**Differential output types**	**Power supply**
EFD44		EIA422		EIA422	5 VDC (input) and 5 VDC (output)
EFD42S		EIA422	10-28 V PNP and push-pull only		5 VDC (input) and 10-28 VDC (output)
EFD42D		EIA422	All 10-28 V	10-28 V	5 VDC (input) and 10-28 VDC (output)
EFD24	All 10-28 V	All 10-28 V		EIA422	10-28 VDC (input) and 5 VDC (output)
EFD22S	All 10-28 V	All 10-28 V	10-28 V PNP and push-pull only		10-28 VDC (input) and 10-28 VDC (output)
EFD22D	All 10-28 V	All 10-28 V	All 10-28 V	10-28 V	10-28 VDC (input) and 10-28 VDC (output)

The maximum quadrature input frequency which can be processed by the filters depends on the selected function mode as follows:

Maximum Quadrature Input Frequency Capability per Filtering Mode				
Speed Grade	**Unfiltered**	**Filtered**	**Recovered x1**	**Recovered x4**
Basic	300 kHz	125 kHz	100 kHz	31.3 kHz



Typical application of an EFD22S filter powering a physically remote encoder (connected via long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

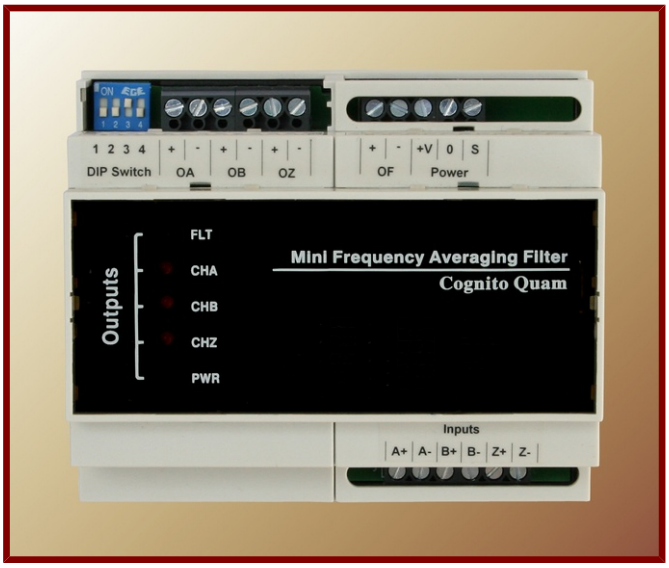
5.d.3. Multimode Encoder Signal Filter Terminator and Mini Line Ordering Information

Multimode Encoder Signal Filter Ordering Information				
Model		**Description**		
Clock/direction x4 output	**Up/down x4 output**	**Filter line**	**Speed grade**	**Input → Output**
EF2402-ALU-L	EF2402U-ALU-L	Terminator	Low	Universal 10-28 V → Universal 5-30 V
EFD22D-DIN-B	EFD22DU-DIN-B	Mini	Basic	Universal 10-28 V → Universal 10-28 V
EFD22S-DIN-B	EFD22SU-DIN-B	Mini	Basic	Universal 10-28 V → 10-28 V PNP/push-pull single ended
EFD24-DIN-B	EFD24U-DIN-B	Mini	Basic	Universal 10-28 V → EIA422
EFD42D-DIN-B	EFD42DU-DIN-B	Mini	Basic	EIA422 → Universal 10-28 V
EFD42S-DIN-B	EFD42SU-DIN-B	Mini	Basic	EIA422 → 10-28 V PNP/push-pull single ended
EFD44-DIN-B	EFD44U-DIN-B	Mini	Basic	EIA422 → EIA422
EFDO02-ALU-H	EFDO02U-ALU-H	Terminator	High	EIA(RS)422 → Universal 5 V
EFDO02-ALU-S	EFDO02U-ALU-S	Terminator	Standard	EIA(RS)422 → Universal 5 V
EFSO02-ALU-L	EFSO02U-ALU-L	Terminator	Low	Universal 5 V → PNP/push-pull type 5-30 VDC single ended
EFU502-ALU-H	EFU502U-ALU-H	Terminator	High	Universal 5 V → Universal 5 V
EFU502-ALU-S	EFU502U-ALU-S	Terminator	Standard	Universal 5 V → Universal 5 V

5.e. Multimode Frequency Averaging Filters

The multimode frequency averaging filter is the signal processing extension of our well established multimode encoder signal filters. While the signal filters clean-up and ensure the electrical and low-level integrity of the encoder signals, the averaging filters, in addition, process these signals to reproduce them at average input frequency.

This specialty filter is particularly suited to slow moving production lines where the ideal control variable is average, and not instantaneous, speed. This happens because instantaneous speed varies randomly due to external events and systematically due to the various coupled, but uncontrolled, mechanisms to the plant power train. As such instantaneous speed cannot be effectively controlled as its measurement is randomly biased and noisy. In contrast, average speed measurement contains only the net effect of these uncontrolled mechanisms and does not allow them to corrupt speed measurement control.



Mini multimode frequency averaging filter in DIN rail IP40 enclosure

Typical applications of the averaging filters are:

- Slow pipe extrusion lines, where raw material feeding (and cost!) is a function of the long-averaged extrusion speed.
- Reciprocating machinery (such as weaving) speed control, whereby performance, energy and operational costs are optimized by controlling average motion speed,
- Engine speed monitoring and control, where shaft rotation is anything but smooth, and
- Vane or turbine flowmeters, where vane vibration due to turbulent flow corrupts rate or dose measurement.

As with its sister products, the filter design is characterized by typical industrial application considerations: low ownership cost, standard interfacing, fool-proof installation, transparent operation, results-oriented and all-inclusive design. The filters feature the following operational characteristics:

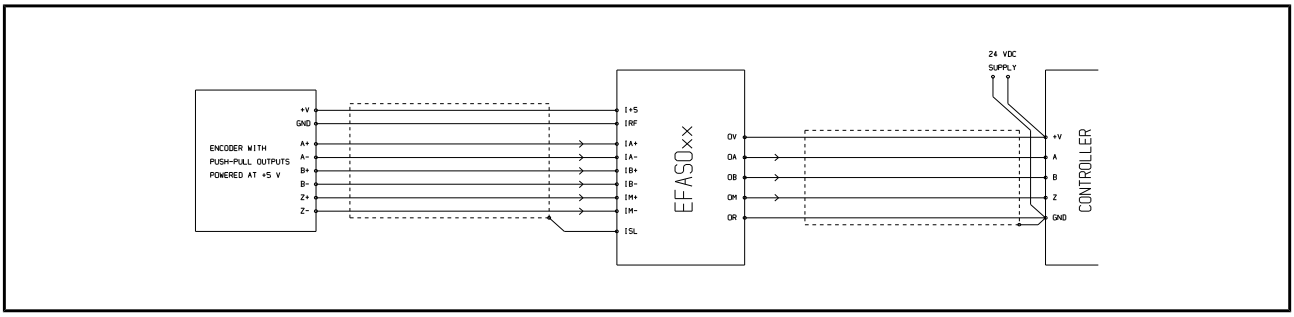
- They are wired in-line between the encoder and the processing equipment. This minimizes and simplifies wiring, usually one of the most significant costs in an installation.
- They interface in a standard way with the encoder outputs and the processing equipment inputs. This enables installation by a non-specialist as well as widening equipment choice.
- They have no special installation requirements, have small physical dimensions and are transparent in operation, and
- They are readily recyclable and made with lead-free materials for minimal impact to the environment.

These unique multimode frequency averaging filters are standard, all-in-one, comprehensive products and process digital encoder quadrature or general clock/direction signals from 1 Hz to 4 kHz and are offered in two standard lines: the fully featured Maxi and the low cost Mini line.

Multimode Frequency Averaging Filter Line Features Overview		
Feature	 **Maxi Line**	 **Mini Line**
Galvanically isolated input and output stages to interrupt unavoidable system ground loops eliminating related noise as well as protecting the input stage of the driven controller from high voltage transients	5 V/ns minimum dV/dt galvanic barrier immunity	0.1 V/ns minimum dV/dt galvanic barrier immunity
Noise and dither prefilter. The inputs are processed for electronic noise and analyzed for mechanical position to recover corrupted motion sequences.	Yes	Yes
Two selectable modes of average calculation: 1. Average displacement period: the encoder displacement is measured over a fixed accumulating time duration and the average frequency is then calculated. With this method measurement time is fixed and the resulting accuracy is variable proportionally increasing with encoder speed, and 2. Average signal period: the encoder period is measured after accumulating a fixed number of displacement pulses and the average frequency is then calculated. With this mode accuracy is fixed and measurement time is inversely proportional to encoder speed.	Yes	Yes
Running average postfilter to smooth the frequency output with selectable sample size.	Yes	Yes
Selectable sample size and measurement time. Measurement sample size and accumulation time is user-selectable for maximum versatility and adaptability.	Yes	Yes
Direction reversal. One of the encoder channels can be complemented to effect a direction reversal, thus saving the rewiring/reconnection of the encoder signals.	Yes	Yes
Supply, signal and worn/faulty encoder indication. Five LEDs indicate the status of the power supply, the three encoder channels and the presence of out-of-sequence signalling, typically caused by a worn or faulty encoder.	Yes	Yes
Independent, galvanically-isolated fault output interfacing to external systems.	Yes	Yes
DIP switch selectable options. All operational parameters are set/reset via DIP switches.	Yes	Yes
Types of EIA(RS)422 input termination.	Standard DC, AC and none	Standard DC and none
Internal dual voltage 115/230 VAC twin isolated supply. Powers the two internally isolated input and output filter sections and can power the monitored encoder with regulated 5 VDC or unregulated 10 VDC.	Yes	No. Power must be supplied to each of the two filter sections.
Enclosure	Cast aluminium, high noise immunity, IP65	Plastic, DIN rail mountable, IP40

Models are characterized by signal format, input/output type, power supply and enclosure type.

Multimode Frequency Averaging Filter Model Selection Table					
Model	**Input Format**	**Input Connections**	**Output Connections**	**Internal Power Supply**	**Enclosure**
Mini SFAFDxxx	Clock, Direction, Enable	EIA422 and all 10-28 V types	EIA422 and all 10-28 V types	No	Plastic, IP40, DIN rail
Mini EFAFDxxx	Encoder quadrature A, B, Z	EIA422 and all 10-28 V types	EIA422 and all 10-28 V types	No	Plastic, IP40, DIN rail
Maxi EFADO01	Encoder quadrature A, B, Z	Differential EIA422 only	Differential EIA422 only	Yes	Cast aluminium, IP65
Maxi EFASO01	Encoder quadrature A, B, Z	EIA422 and single ended: all 5 V, 5-30 V NPN and push-pull only.	Single ended 5-30 V PNP and push-pull only.	Yes	Cast aluminium, IP65

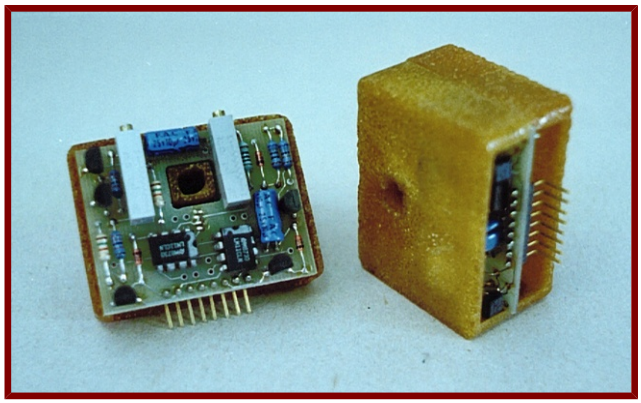


Typical application of an EFASO filter powering a physically remote encoder (connected by long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

Frequency Averaging Filter and Accessories Ordering Information	
Model	**Description**
EFADO01-ALU	Maxi encoder frequency averaging filter, EIA422 inputs and Universal 5 V outputs.
EFAFD22D-DIN	Mini encoder frequency averaging filter, universal 10-28 V input and output.
EFAFD22S-DIN	Mini encoder frequency averaging filter, universal 10-28 V input, 10-28 V single ended PNP and push-pull output.
EFAFD24-DIN	Mini encoder frequency averaging filter, universal 10-28 V input, EIA422 output.
EFAFD42D-DIN	Mini encoder frequency averaging filter, EIA422 input, universal 10-28 V output.
EFAFD42S-DIN	Mini encoder frequency averaging filter, EIA422 input, 10-28 V single ended PNP and push-pull output.
EFAFD44-DIN	Mini encoder frequency averaging filter, EIA422 input, EIA422 output.
EFASO01-ALU	Maxi encoder frequency averaging filter, Universal 5 V inputs and 5-30 V PNP and push-pull single ended type outputs.
SFAFD22D-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input and output.
SFAFD22S-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input, 10-28 V single ended PNP and push-pull output.
SFAFD24-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input, EIA422 output.
SFAFD42D-DIN	Mini clock/direction frequency averaging filter, EIA422 input, universal 10-28 V output.
SFAFD42S-DIN	Mini clock/direction frequency averaging filter, EIA422 input, 10-28 V single ended PNP and push-pull output.
SFAFD44-DIN	Mini clock/direction frequency averaging filter, EIA422 input, EIA422 output.
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC (accessory to provide power from 3x400 VAC lines)

5.f. Hall Effect Sensors

Our Hall effect technology addresses electric current and power sensing applications.



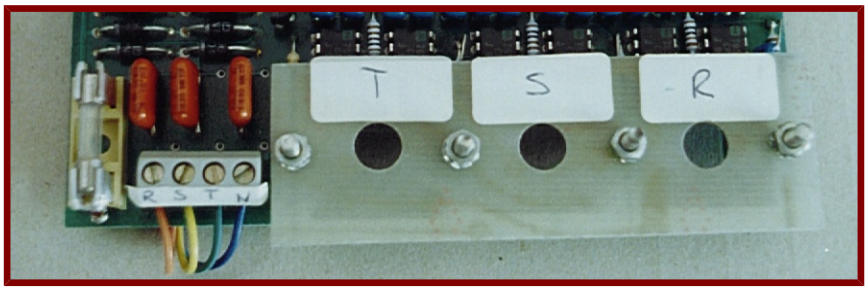
PCB-ready current/power sensor (unpotted).
Handles bipolar currents up to 50 A with an accuracy of 0,5 %.

The sensors can be used for:

- Plain AC, DC or of-any-waveform current/power sensing,
- Power/energy monitors/analyzers,
- Power supply efficiency meters.

The features of this technology are:

Hall Effect Sensor Technology Features	
Form	Practically any package: PCB-ready for smaller units, “current-transformer” type rings (DIN rail mountable or not) and, of course, OEM sub-assembly.
Versatile electronics	The sensor is auto-corrected for offsets, drifts and calibration.
Phase compensation	There is also phase compensation of the magnetic circuit inductance. This is particularly important in measuring the active and reactive components of power.
Current compensation	As an option we can add a current compensation facility to improve linearity and dynamic range.

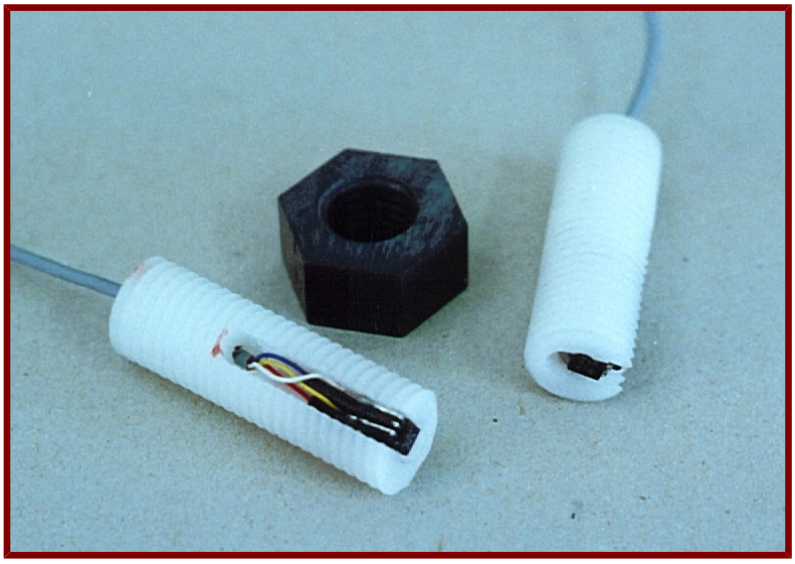


Detail of a 3-phase power analyzer, supplied as an OEM solution.

Ordering Information	
Model	**Description**
HEC50	Hall effect 50 A bipolar current sensor
HEP1	Hall effect single-phase power sensor
HEP3	Hall effect three-phase power sensor

5.g. Self-aligning Narrow Focus Proximity Sensors

The sensor is magnetic and is designed to detect-sized features such as gear teeth. (It is a spin-off from a robotics project where we could not couple a robust enough encoder mechanism).



Sensors built in a nylon M16 screw section (unpotted).

We see the following applications for this sensor:

- In place of an encoder where the encoder and its mechanical link is not a practical proposition. Examples here are use with linear gears/rulers and high-reliability, no-moving-parts operation in “unfriendly” environments, and
- In cases where the required resolution does not justify the cost and complexity of an encoder.

The sensor is supported by its own electronics and currently the system has the following features:

Proximity Sensor Features	
Narrow-focus magnetic circuit	To detect millimetre-sized targets at a distance of up to 5 mm.
Self-alignment	Up to 40% mechanical eccentricity, misalignment and/or wobble in the relative position to the target as well as drift-free electronics.
Interface	Encoder-like behaviour and interface.

This technology is offered as an OEM product.

Ordering Information	
Model	**Description**
NFP	Self-aligning, narrow focus, proximity sensor.

5.h. KADAxx Production Testers

The KADAxx line of instruments address the needs of CE compliance testing at the production floor.

Dielectric strength tester

Currently, the line consists of the following instruments:

- Dielectric strength tester. 0 to 6 kV with test duration timer,
- Leakage to protective ground. Measures the leakage to the ground (or external cover/shell) of the device-under-test, and
- Protective grounding conductivity. Up to 10 A excitation with test duration timer.

The design is characterized by typical industrial application considerations: minimal cost, fool-proof installation and simple operation.

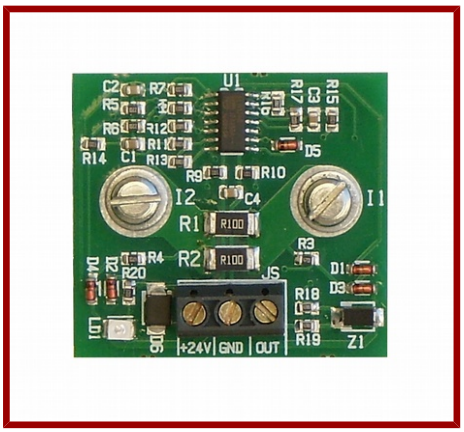
Their enclosure allows for stand-alone (bench) operation or combined in 19” racks.

Ordering Information	
Model	**Description**
KADA0	Dielectric strength tester
KADA1	Leakage to protective ground tester
KADA2	Protective grounding conductivity tester

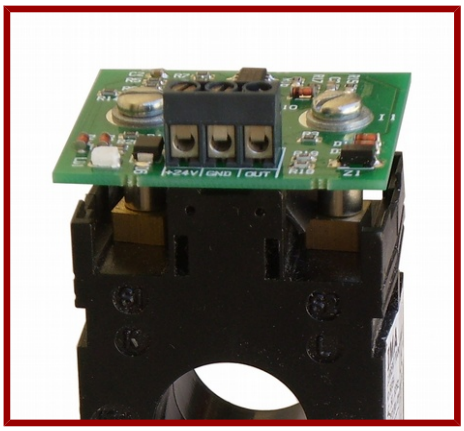
5.i. Signal interfaces and converters

Our sensor, actuator, transducer and measurement expertise includes signal interfacing and conversion. In this light, we are offering a number of practical and versatile interface and signal conversion technologies.

5.i.1. Current transformer interface



Current transformer interface, standard 27 mm M4 terminal spacing.

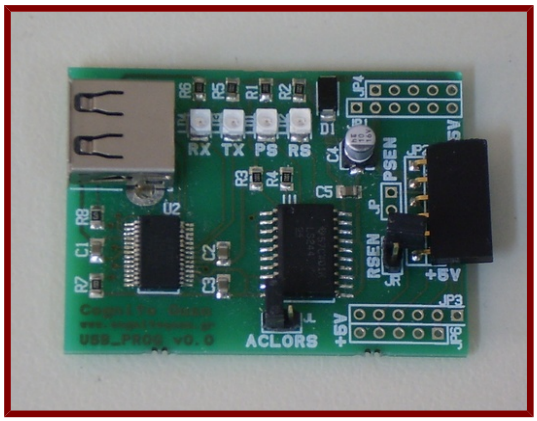


Interface mounted on current transformer terminals

Our current transformer interface converts the 0-5 A secondary current to a 10 VDC voltage signal. Powered by 24 VDC and mounted directly on the transformer terminals it addresses PLC and similar current measurement applications in motor and power line monitoring where 0-10 VDC analog input stages are more widely available.

Ordering Information	
Model	**Description**
CTIFC_5-10_24	Current transformer interface, 5 A rms - 10 VDC, 24 VDC supply.

5.i.2. USB to TTL interface



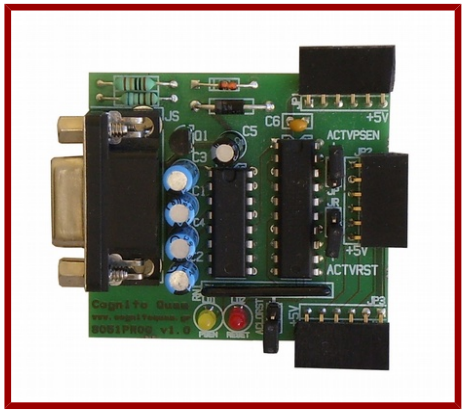
USB to TTL interface

The USB to TTL interface converts the virtual USB serial port RX, TX, RTS and DTR signals to their respective active low TTL levels. It mainly addresses low level communication tasks such as processor programming, product debugging and monitoring.

It can also be used on all our processor-based products (fits directly on their programming pins) for use with the respective product accompanying MS-Windows setup and monitoring software.

Ordering Information	
Model	**Description**
USB-TTL_IFC	USB to TTL interface

5.i.3. EIA(RS)232 to TTL interface

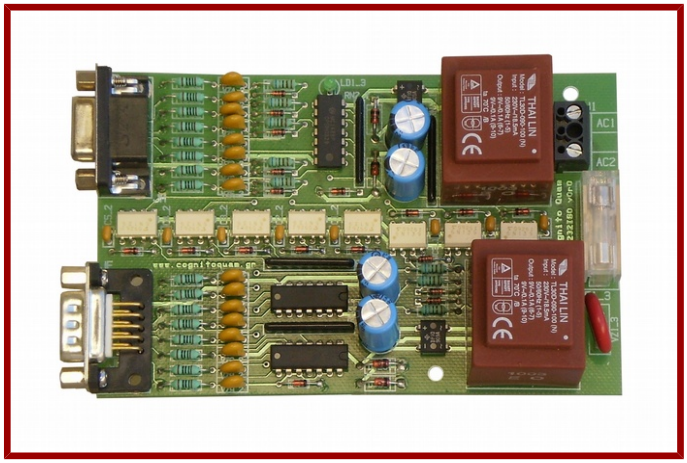


The EIA(RS)232 to TTL interface converts the EIA(RS)232 RX, TX, RTS and DTR signals to their respective active low TTL levels. It mainly addresses low level communication tasks such as processor programming, product debugging and monitoring.

It can also be used on all our processor-based products (fits directly on their programming pins) for use with the respective product accompanying MS-Windows setup and monitoring software.

Ordering Information	
Model	**Description**
RS232-TTL_IFC	EIA(RS)232 to TTL interface

5.i.4. EIA(RS)232 isolator

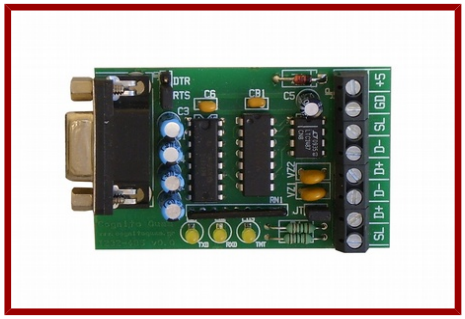


The EIA(RS)232 isolator galvanically isolates all eight EIA(RS)232 signals between its data set and data terminal ports.

It is powered with 230 VAC and features standard 9-pin D-Sub connectors.

Ordering Information	
Model	**Description**
RS232_ISO_230	EIA(RS)232 isolator, 230 VAC supply.

5.i.5. EIA(RS)232 to EIA(RS)485 interface

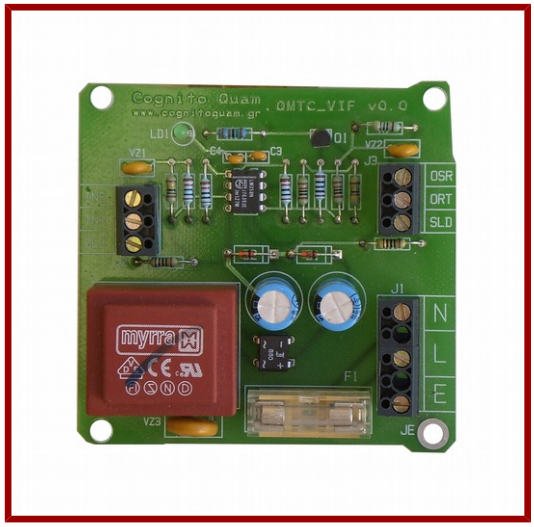


The EIA(RS)232 to EIA(RS)485 interface converts full-duplex EIA(RS)232 to half-duplex EIA(RS)485 signalling. It typically enables a PC to control any of our products featuring an EIA(RS)485 port.

It is powered with 5 VDC at the EIA(RS)485 terminals and data flow is controlled via the DTR or RTS EIA(RS)232 signals.

Ordering Information	
Model	**Description**
RS232-485_IFC_5	EIA(RS)232 to EIA(RS)485 interface, 5 VDC supply.

5.i.6. Voltage to current interface



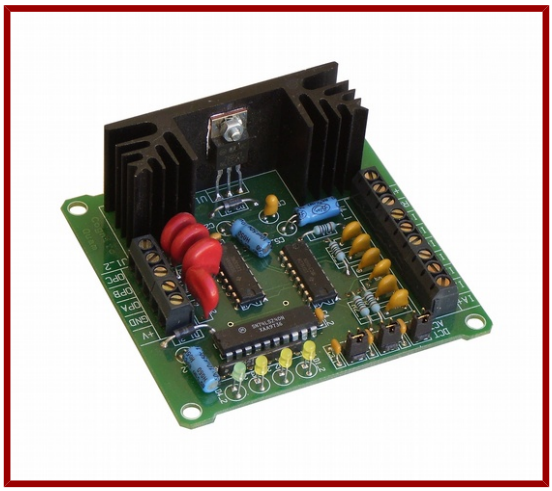
The voltage to current interface converts a 0-10 VDC signal to 0-20 mA format typically addressing long cable sensor/actuator analog signalling applications.

It is powered with 230 VAC and fits in standard sized aluminium or plastic enclosures.

Ordering Information	
Model	**Description**
VI_IFC_10-20_230	Voltage to current interface, 10 VDC - 20 mA, 230 VAC supply

5.i.7. General purpose 24V interfaces

The general purpose 24V interfaces fit in standard sized enclosures and address the need for isolation and convertion in the 24 VDC application world:



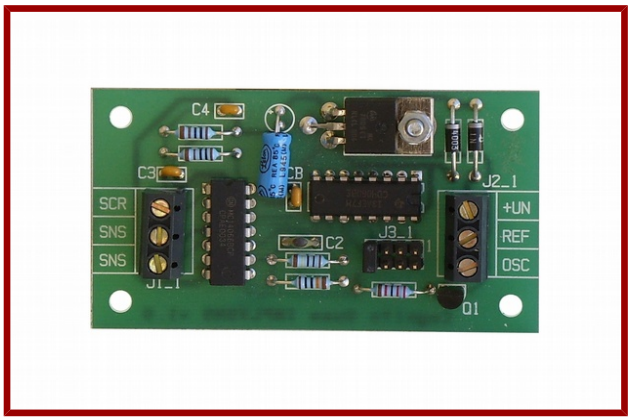
The **3-channel EIA(RS)422 to single end 24 VDC** typically converts encoder EIA(RS)422 differential signals for use in low-end PLC applications.

The **4-channel 24 VDC input to uncommitted optocoupler output** is typically used in all signal isolation and convertion applications where a 24 VDC input signal is converted to an isolated 10-20 mA control signal. Both optocoupler outputs of each channel are available enabling each channel to be connected in PNP or NPN mode as needed.

The **4-channel 24 VDC power output interface** isolates four 24 VDC NPN controlling inputs to 10-28 VDC, 1 A push-pull outputs, typically in solenoid activating applications.

Ordering information	
Model	**Description**
RS422-S24_IFC	3-channel EIA(RS)422 to single end 24 VDC, 24 VDC supply
ISO_24-OC	4-channel 24 VDC input to uncommitted optocoupler output
ISO_24-24	4-channel 24 VDC power output isolator/interface

5.i.8. Capacitance to frequency interface



Our capacitance to frequency interface converts sensor capacitance to a ratiometric frequency output and is aimed at simple capacitance detection applications such a water level detection and material humidity.

The sensor capacitance, when sampled, is internally paralleled with the on-board reference capacitor and as such the output mark-space ratio varies to represent the two signal periods: the one generated with the reference capacitor only and the other with the added sensor capacitance.

The integration time and accuracy are selected via the on-board jumper straps.

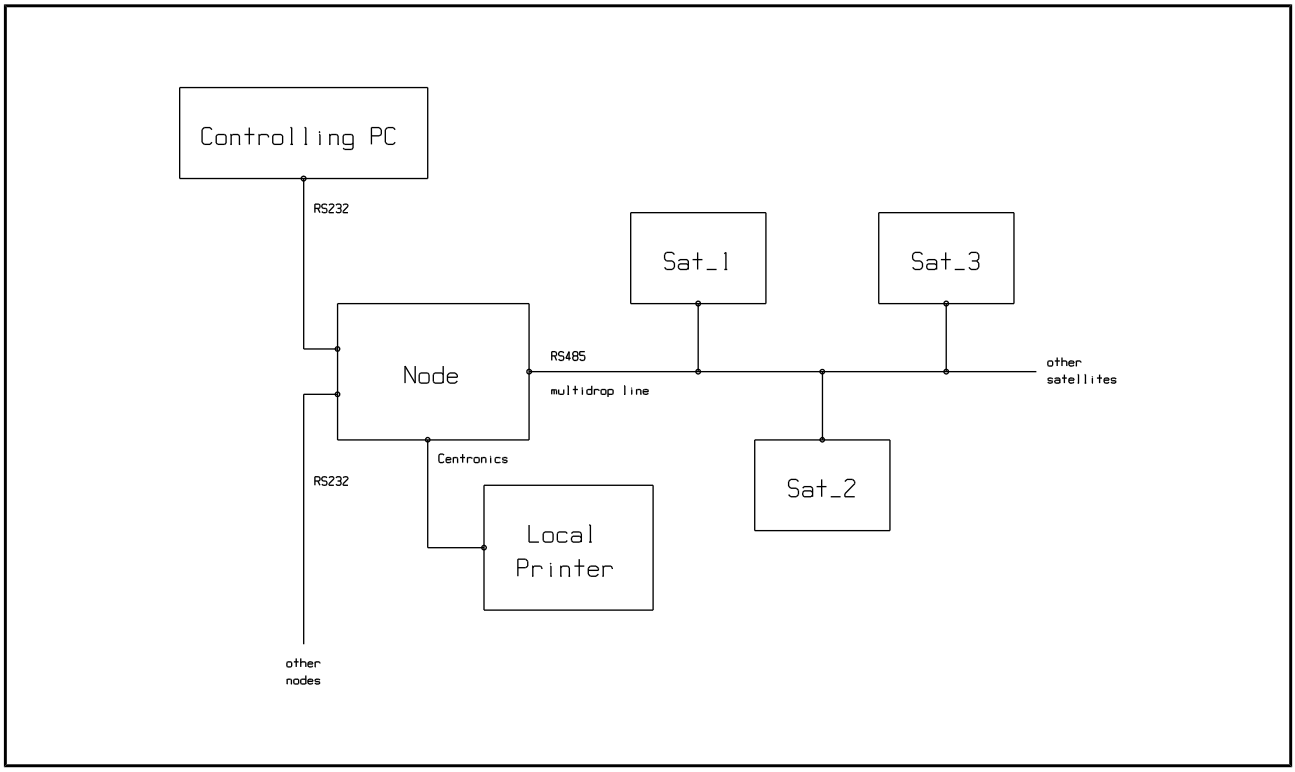
Ordering Information	
Model	**Description**
CAP-FRQ_IFC_24	Capacitance to frequency interface, 24 VDC supply.

6. QUAMATIC DISTRIBUTED AUTOMATION PLATFORM

6.a. QUAMATIC Technology Description

Our Quamatic technology addresses distributed automation needs and is a standard feature of all our products with network connectivity.

Its architecture reflects the reality of industrial and commercial plants. Every plant is unique in organization, function and people. In all plants however, information (in the form of data and messages) is produced and consumed all over the place concurrently.



Quamatic architecture

Quamatic functions are distributed in a chain of 'nodes', each controlling a EIA(RS)485 multidrop line of 'satellites'.

Each Node performs the data processing and message passing associated with its satellites, while each satellite performs a specific local role as required by the plant organization.

The characteristics, functions and parameters of the Node and its satellites are coded in the form of a downloadable 'Configuration File'. This and overall control is performed by any serial data device, usually a PC running relevant application software.

It is this architecture which makes a Quamatic system an effective and efficient tool offering:

- **Structured organization**. Each Node is employed to handle tasks characterized by, for example, location, plant function or production line.

- **Customization**. Each satellite is designed and employed for a specific function in the plant. This can be, among others, communicating with a PLC, monitoring of machines (production and consumption volumes, downtimes and their causes etc.) or programming NC tools.

- **Flexibility and adaptability**. The system is adaptable because all customization effort is concentrated on the design of the satellites. Flexibility is ensured by the software nature of the Configuration File. The data format of each satellite and the procedures to be performed based on the data are coded in this file. Thus the system can be updated, upgraded or extended with minimum effort.

- **Minimum custom hardware**. The Node is a standard piece of hardware and only the satellites have to be designed specifically for a function. In addition to the standard products, general purpose satellite platforms are available (and more are being made), for example a multiprotocol serial data interface, thus reducing the problem to programming these for the specific application.

- **Simple installation**. The multidrop nature of the EIA(RS)485 line calls for a simple, inexpensive cable to connect all satellites. Nor are distances a problem as the EIA(RS)485 signals are differential. Adding a satellite on the line calls only for the cable to be extended to the new member.

- **Minimum design time**. The availability of standard hardware and procedures allows the design effort to be concentrated on plant specifics, thus saving time from reinventing the wheel.

- **Freely available, open software**. All Cognito Quam products with serial communications are automatically detected by Quamatic software. Quamatic is open, freely available, free-to-use and easy-to-implement byte level protocol described and specified fully in the product's manual. Diagnostic, setup and operation binaries are also available for free on request by e-mail from <qsw@cognitoquam.gr>.

Quamatic Node

For a more extensive description, the document *Quamatic, Industrial Automation and Product Data Management System* is available.

6.b. QUAMATIC Example Applications

Collecting weighing (consumption) data from a PLC. The food plant processes are controlled by a PLC. The Quamatic system interfaces to the PLC serial port to collect the consumed quantities as they are fed by the weighing machines. The data is timestamped and recorded on the Node's printer as well as supplied to the controlling PC. Thus the data is available for stock accounting as well as for the various reports to the management.

Collecting data from weighbridges. The fluid concrete carrying lorries are weighed before leaving for the building sites. The Quamatic system collects the data from the weighing points, registers them and passes them on to the PC for accounts updating and shipping documents printing.

Monitoring of packaging machines. Packaging machines are monitored for production volumes as well as for downtime causes (for example running out of packaging material or misfit boxes). This data, again, is used to analyze and improve production in a timely and accurate way as well as allowing the operator to concentrate on the job and not on filling in production reports.

Flexible manufacturing by controlling NC tools. The Quamatic helps the efficient production of small batches of mechanical parts by collecting and distributing data to and from the plant NC tools. The collected data are used by the production staff and the accounts department while the distributed data are the programming commands to the tools.

Payroll data collection and entry vetting. The Quamatic collects attendance data from card readers at all entry/exit points in the plant as well as vetting card bearers for security. The data is recorded and passed to the accounts/payroll/personnel department for final processing. Security violations are signaled both locally and elsewhere as appropriate.

ISO9000 Quality System support. The Quamatic supports the ISO9000 Quality System by collecting and logging all the required data in real time, prints the necessary documents and distributes procedure and instruction messages. Quality System procedures and instructions are always correctly followed and all actions are logged and processed at minimum manpower cost!

Automating and running of steel sheet forming station. The Quamatic monitors the state of the station through the added sensors (sheet length, input coil feed, output removal etc.) and controls the station actuators (guillotine, feed, removal, alarms etc.). At the same time, the system collects production data as well as assisting the operator in job scheduling.

Your application!

6.c. Node Hardware

The Quamatic Node controls all communications in the network. These are between satellites, between a satellite and the Node, and between a satellite and a Node port.

Currently two models of Node are offered: a basic (“BNode”) and a full featured logging (“LogNode”) one.

BNode addresses simple dedicated PC controlled installations and has the following features:

Quamatic BNode Features	
Quamatic net port	Multidrop network of up to 255 satellites EIA(RS)485 port.
Master serial port	Multipurpose EIA(RS)232 port for controlling device (typically a PC) connection.
Communication modes	Satellite-Satellite, Satellite-Node, Broadcasting, Satellite-Serial, Serial-Node.

LogNode addresses the needs of remote, unattended installations such as pump-houses, refrigerated warehouses and difficult-to-access plant. Features are:

Quamatic LogNode Features	
Quamatic net port	Multidrop network of up to 255 satellites EIA(RS)485 port.
Master serial port	Multipurpose EIA(RS)232 port for controlling device (typically a PC) connection. This can be a modem connected to a telephone line for remote operation of the Node and the network. The LogNode Configuration file allows for all modem commands and functions.
Slave serial port	Multipurpose EIA(RS)232 port for a slave Node, an EIA(RS)232 connected Satellite or a non-Quamatic device (e.g. refrigeration unit). The LogNode Configuration file allows for the full parametric description of the non-Quamatic protocol (headers, tails, bytes of interest etc.).
Parallel port	PC type parallel port to connect printers and similar hard-copy logging devices.
Real time clock	Battery backed-up real time clock is used as a system reference and to timestamp logged data.
Communication modes	Satellite-Satellite, Satellite-Node, Broadcasting, Satellite-NodePort, NodePort-Node, NodePort-NodePort.
Flash memory data log	1Mbyte space for event and data logging.

Ordering Information	
Model	**Description**
BNode121	Quamatic B(asic)Node 121
LogNode	Quamatic LogNode
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC.

7. RESEARCH AND DEVELOPMENT SERVICES

Our research and development services are available in integrating our products in industrial systems or individual products as well as in the design of new and challenging devices and equipment.

As such we cooperate closely and support our customers in their endeavour for a better product.

Participation in international R&D projects is also natural ground to us as we have successfully contributed to a number of these.

8. ALL PRODUCT ORDERING INFORMATION

Model	Description	Page
A8	Field configurable panel controller	48
AR1, AR1-H	Panel thermostat/hygrostat and thermostat	36
AVSR3-xxx-x-xxx	Triple switch autocalibrating variable step regulator	1
BAO-1	12+8 bit I/O and analog output panel network controller	39
BNode121	Quamatic B(asic) Node 121	94
BSxTxx	Basic Soft Start	57
CACSW-xxx-x-xxx	Integrated power factor capacitor switch	63
CAP-FRQ_IFC_24	Capacitance to frequency interface, 24 VDC supply	90
CSNS	Capacitive sensor controller	70
CTIFC_5-10_24	Current transformer interface, 5 A rms - 10 VDC, 24 VDC supply	83
DEFOG xxW12	Mirror defogging element	66
EFAFDxx/x-DIN	Mini encoder frequency averaging filter.	77
EFDxx/x-DIN-B	Mini multimode encoder signal filter, DIN rail enclosure	72
EFxxxxx-ALU	Maxi encoder frequency averaging filter	77
EFxxxx/x-ALU-x	Terminator multimode encoder signal filter	72
ELVx	Elevation distributed lift control	23
HExx/x	Hall effect power/current sensor	80
Humxxx/x	Humidity sensor	69
ICCDxx	xx A/phase integral cycle control drive for thermal loads	59
IMOD2	2 HP inverter module	62
INVDxxxx	AC motor inverter drive	51
ISFT-vv/c	Intelligent motor starter panel controller (vv x100 V, c x100 mA)	29
ISO_24-xx	4-channel 24 VDC interface	89
JJ_xxx	Jolly Jogger treadmill controller	34
KADAx	Production tester	82
LogNode	Quamatic LogNode	94
Mistral2	2 HP ventilation fan control	61
Motion1	Motion One position/motion controller	21
NFP	Self-aligning, narrow focus proximity sensor	81
NSFTxx/-xx	Soft starter	54
NSFTQ-x	NSFT/ICCD panel controller	32
PFC1-x-xxx	PFC1 fast power factor controller	9
PFCDxx-xxx	PF active/reactive current detector	19
QSS_4_230	4 Channel QSS solid state relay, 1x230 VAC.	46
RCCx-xxx	Reactive current control	17
RCCSx-x-xxx	Reactive current controlled switch	13
RS232-TTL_IFC	EIA(RS)232 to TTL interface	85
RS232_ISO_230	EIA(RS)232 isolator, 230 VAC supply	86
RS232-485_IFC_5	EIA(RS)232 to EIA(RS)485 interface, 5 VDC supply	87
RS422-S24_IFC	3-channel EIA(RS)422 to single end 24 VDC, 24 VDC supply	89
SFAFDxx/x-DIN	Mini clock/direction frequency averaging filter	77
SSRAC	Solid state relay analog controller	41
SSR_ICCD	SSR_ICCD Solid State Relay (SSR) Integral Cycle Control Drive	42
USB-TTL_IFC	USB to TTL interface	84
UTP	Fire protection/fire damper UTP controller	50
VBR-1	Vibrating actuator control	65
VI_IFC_10-20_230	Voltage to current interface, 10 VDC - 20 mA, 230 VAC supply	88
VSPFC-xxx	Variable step power factor controller	5
XFR400230	Control voltage supply transformer, 90VA, 400/230 VAC (accessory to provide power from 3x400 VAC lines)	

9. COGNITO QUAM PROFILE

Cognito Quam Electrotechnologies Ltd. (established in 1990) is a privately held engineering and commercial company specializing in industrial electronics and their application. The company expertise covers all aspects of applications for the factory environment namely measurement (transducers and sensors), data processing and communication, control and actuation, automation and robotics and power and energy electronics.

Cognito Quam has contributed and been involved in the design and development of the following technologies, machinery and devices:

- Power factor controllers,
- Motor voltage and frequency inverters and converters,
- Thermal load control and management,
- Robotic interfaces and protocol converters,
- Adaptive panel controllers,
- Robotics controllers,
- Variable speed drives,
- Olive oil processing rejects control equipment (FAIR contract),
- Low Voltage and EMC CE marking compliance devices and equipment for production lines,
- Portable dioxine-furan instrumentation (SMT contract),
- Three-phase programmable soft-starters,
- Hard real time job scheduling systems,
- Hard real time industrial distributed data systems (Brite-EuRam subcontract),
- Calibration rig and supplies for power meters,
- Electrical utility Hall effect energy and power meters,
- Industrial data networks,
- Battery chargers and UPS inverters,
- Solar power air conditioning telemetry and control systems (Thermie subcontract)
- Small switching power supplies,
- Multi-port communication PC cards,
- Ship oily water separators, and
- Modem controllers.

Cognito Quam also offers its research and development services in integrating its products in larger industrial systems products as well as in the design of new and challenging devices and equipment. As such the company cooperates closely and supports its customers in their efforts for a better product.