



elektrosistem



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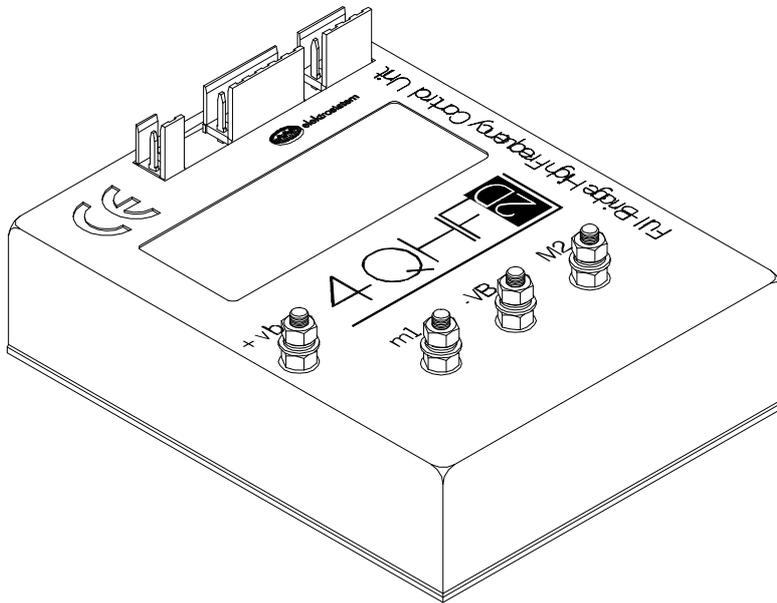
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4QHF 2D

HIGH FREQUENCY ELECTRONIC CONTROL UNIT WITH ENERGY RECOVERY

The bidirectional high frequency electronic control unit with energy recovery and aided by microprocessor type 4QHF 2D has been added to the newest range of products manufactured by ELEKTROSISTEM.

Conceived for permanent magnet motors and realized in compliance with the most recent security provisions for the application on EC-vehicles, it is produced in a wide power range (from 45 A up to 140 A). The acceleration adjusting

device allows the vehicle to gradually and regularly reach the maximum speed. The current limiter enables the operator to adjust the max. current supplied to the motor.

This control unit is provided with a variable regenerative braking that can be adjusted by the operator according to his needs and acts during the vehicle's deceleration, reverse and by pedal release.

MAIN TECHNICAL FEATURES

- Control unit aided by microprocessor.
- Operation parameters adjustable through a programming display or by PC.
- Slow starting through adjustable acceleration slope.
- Settable limiter of the max. current supplied to the motor.
- Proportional action thermal limiter.
- Recovery braking system activated during deceleration, by pedal release and in reverse.
- Settable limiter of the max. braking current.
- Control system by a 5K potentiometer connected to 3 wires.
- Control system by a potentiometer connected to 2 wires with adjusting angle on request.
- Total protection against battery polarity inversion thanks to an internal line relay.
- Intervention of the safety block in case of short circuit of the Mos units.
- Intervention of the safety block in case of potentiometer breakdown.
- Intervention of the safety block when, turning the key, the potentiometer is not on 0 and disabling by resetting the potentiometer to 0.

TECHNICAL SPECIFICATIONS

- Voltage rating	12-24-36-48V
- Allowed power supply variation	from 85% to 125%
- Operation frequency	16 KHz
- Operation temperature	-20°C / +40°C
- Humidity at 25° C	90 %
- Thermal limiter action	from 70°C to 80°C
- Weight 4QHF 2D 45/60A	350 gr.
- Weight 4QHF 2D 90/140A	450 gr.

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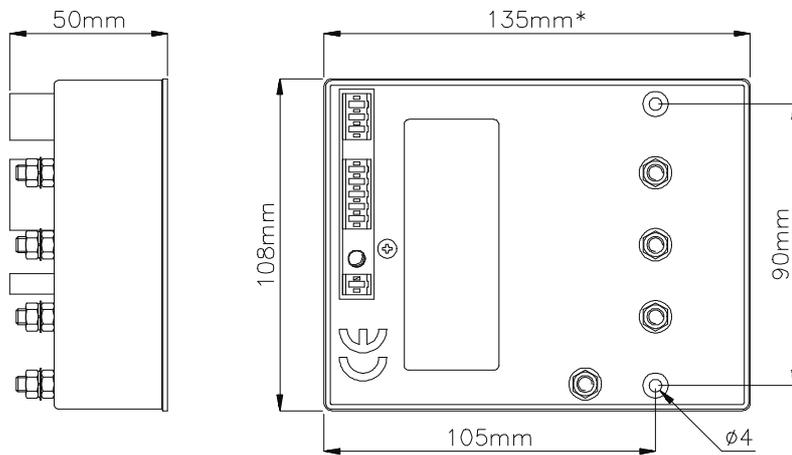
MODELS

Size	Starting Current	Current/Min.	Current/Hour**
45 A*	45 A	40 A	18 A
60 A	60 A	55 A	21 A
90 A	90 A	81 A	32 A
140 A	140 A	121 A	48 A

* Not available at 48V.

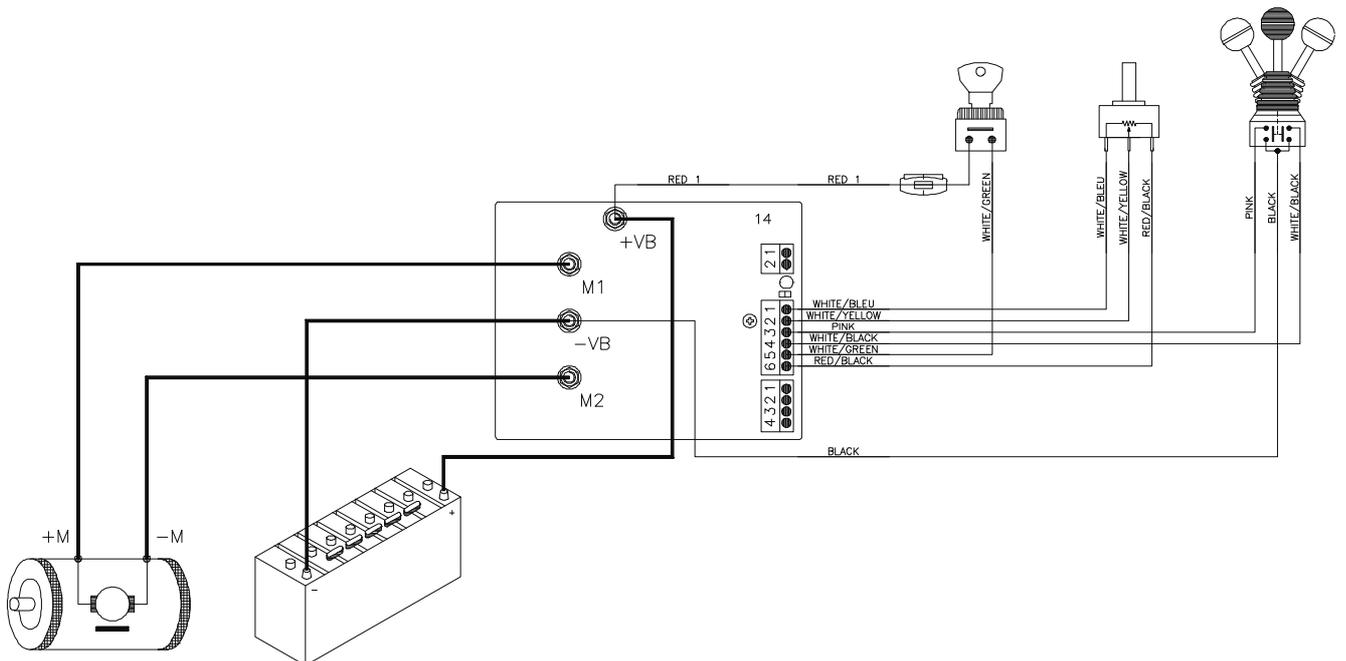
** In free air conditions.

DIMENSIONS



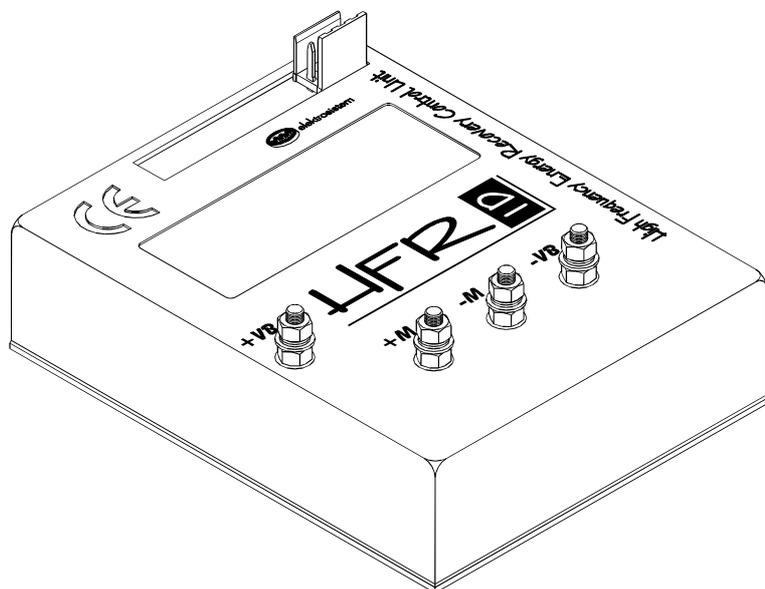
* 112mm in the 45A and 60A model.

CONNECTION DIAGRAM





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HFR 1D

HIGH FREQUENCY ELECTRONIC CONTROL UNIT WITH

The unidirectional high frequency electronic control unit with energy recovery type HFR 1D has been added to the wide range of products manufactured by ELEKTROSISTEM. Conceived for permanent magnet motors, this equipment complies with the newest security provisions for the application on EC-vehicles and is produced in a wide power range (from 60 A up to 150 A).

The acceleration adjusting device allows the vehicle to gradually and regularly reach the maximum speed. The current limiter enables the operator to adjust the max. current supplied to the motor.

This control unit is provided with a variable regenerative braking whose max. value is fixed by the recovery braking adjusting device.

MAIN TECHNICAL FEATURES

- Slow starting through adjustable acceleration slope.
- Presettable limiter of the max. current supplied to the motor.
- Thermal limiter with a proportional action.
- Recovery braking system activated by deceleration or by pedal release.
- Presettable limiter of max. braking current.
- Control system by a 5K or a 10K potentiometer connected to 3 wires.
- Control system by a potentiometer connected to 2 wires with adjusting angle upon request.
- Total protection against battery polarity inversion by means of an internal line relay.
- Protection against short circuits of the mos units.
- Protection against potentiometer breakdown.
- Intervention of the safety block when, turning the key the potentiometer is not on the value 0.
- Disabling of the safety block by resetting the potentiometer to the value 0.

TECHNICAL SPECIFICATIONS

- Voltage rating	12-24-36V
- Allowed supply variation	from 85% to 125%
- Operation frequency	>= 18 KHz
- Operation temperature	-20°C/+40°C
- Humidity at 25°C	90%
- Thermal limiter action	80°C
- Max voltage supplied at 12 VB	94%
- Max voltage supplied at 36 VB	98%
- Weight	500g

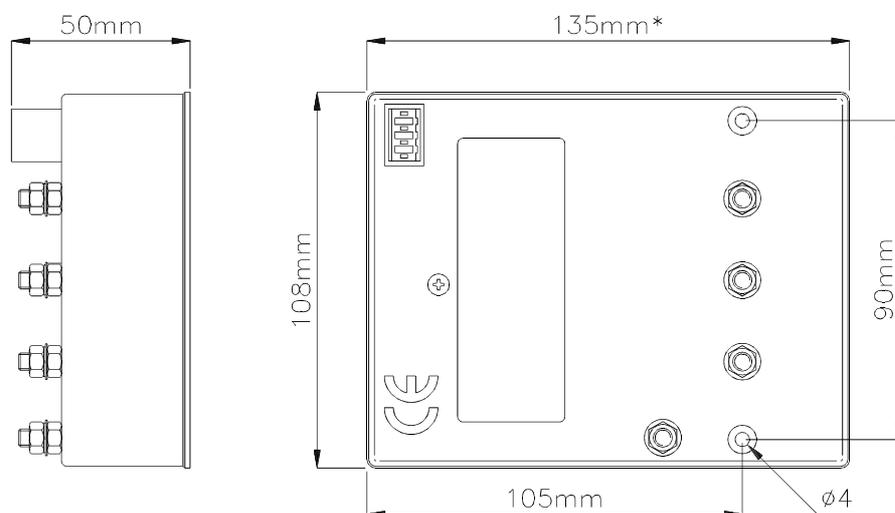


MODELS

Size	Starting Current	Current/min	Current/hour*
60 A	60 A	55 A	21 A
90 A	90 A	81 A	32 A
120 A	120 A	110 A	42 A
150 A	150 A	135 A	53 A

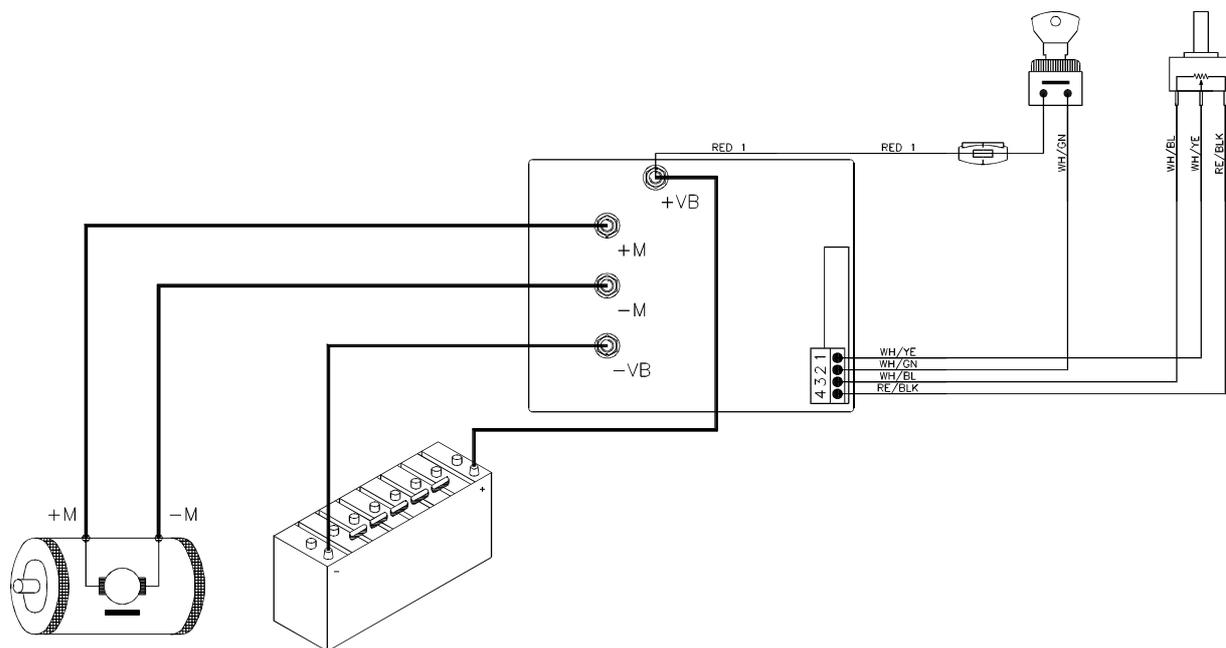
* In free air conditions.

DIMENSIONS



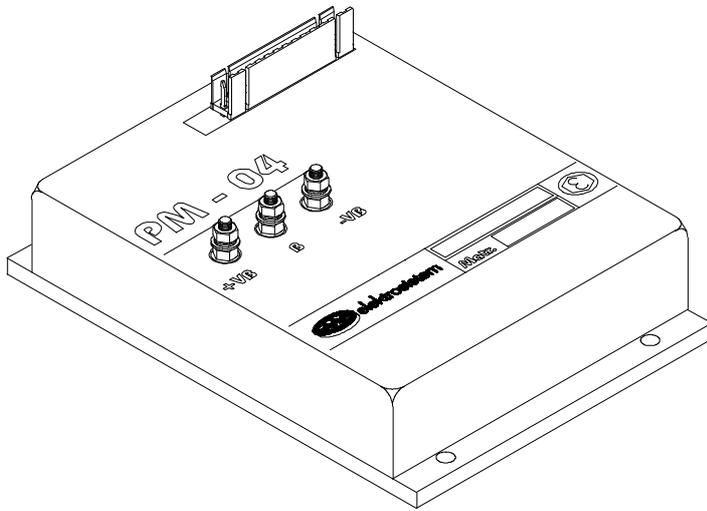
* 112mm in the 60A model.

CONNECTION DIAGRAM





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PM-04B

HIGH FREQUENCY ELECTRONIC CONTROL UNIT WITH MICROPROCESSOR AND ENERGY RECOVERY

The high frequency bidirectional electronic control unit with energy recovery type PM-04B has been added to the newest range of products aided by microprocessor. Designed by ELEKTROSISTEM for permanent magnet motors according to the mosfet technology and in compliance with the safety regulations for the application on EC-vehicles, the control unit PM-04B ensures an automatic regenerative braking by pedal release, during deceleration or in reverse. The microprocessor ensures a higher performance when compared

with the traditional analogic systems along with the possibility to modify the running parameters by means of a programming display (ITS) or a PC interface that may be supplied with the relative software. The control unit PM-04B is available in the power range included between 150 and 270 Amp. and in the voltages 12, 24, 36 and 48 V.

MAIN TECHNICAL FEATURES

- Control unit aided by microprocessor.
- Operation parameters adjustable through a programming display or a PC-interface.
- Total protection against battery polarity inversion.
- Proportional action thermal limiter.
- Recovery braking system acting by pedal release or in reverse.
- Intervention of the safety block in case of short circuit of the mos units.
- Intervention of the safety block in case of potentiometer breakdown.
- Intervention of the safety block when, turning the key, the potentiometer is not on the value 0.
- Possibility to connect and drive an electromagnetic brake.
- Control system by a 5K potentiometer that may be connected to 2 or 3 wires.
- Control system by a smaller section of the potentiometer in order to reduce the adjusting angle.
- Personalization of operation parameters:
 - Slow starting through adjustable acceleration slope
 - Limiter of the acceleration current
 - Limiter of the braking current
 - "Under voltage" device for battery protection
 - "Over voltage" device for equipment protection
 - Limiter of the max. voltage applied to the motor separated for forward and reverse running.

TECHNICAL SPECIFICATIONS

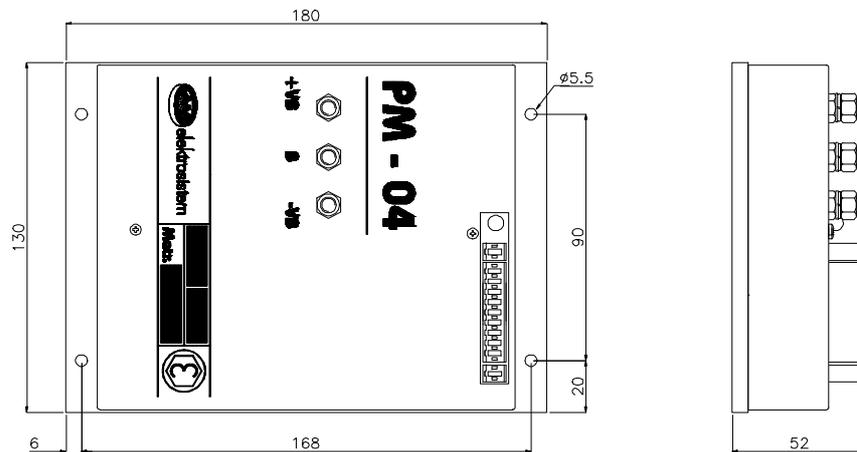
- Voltage rating	12-24-36-48V
- Standard nominal current	150/350A
- Operation frequency	17KHz
- Operation temperature	-20°C / +40°C
- Thermal limiter action	from 70° to 80°C
- Weight	800 gr.

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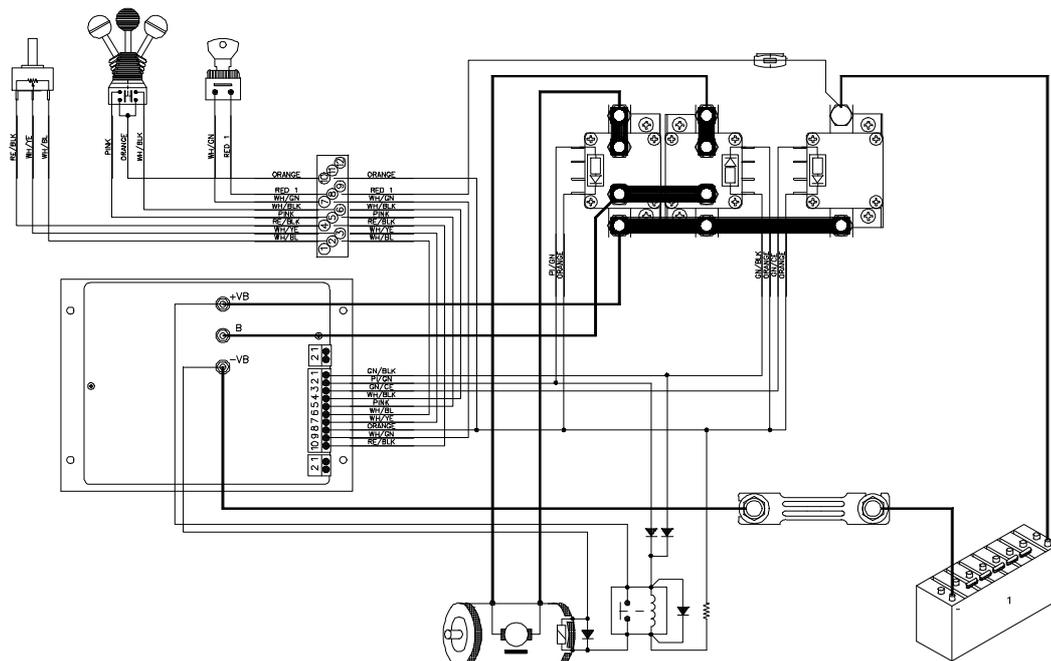
MODELS

Size	Starting current	Current/Min	Current/hour
150 A	150 A	120 A	50 A
180 A	180 A	150 A	60 A
200 A	200 A	170 A	65 A
250 A	250 A	210 A	85 A
350 A	350 A	280 A	110 A

DIMENSIONS



CONNECTION DIAGRAM





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4Q BIG

HIGH FREQUENCY CONTROLLER FOR PERMANENT MAGNET MOTORS

4Q BIG is a bidirectional high frequency controller designed to control DC permanent magnet motors.

A MOSFET full bridge power section provides reversing with no need to use running contactors. The equipment must be equipped with a main contactor to guarantee insulation of the controller from the battery in emergency situations to meet the safety requirements in force.

The controller features regenerative braking acting when the running control is released and during reversing.

Operation parameters can be modified by programmer or PC and serial interface.

Outputs to control main contactor, power steering and electromagnetic brake are available. All outputs feature coil protection. 24V contactors are to be used for all battery voltages, only the electromagnetic brake is directly powered by the battery.

FEATURES

- Controller for DC permanent magnet motors
- MOSFET technology and high frequency operation
- Microprocessor control with self test of control circuitry
- Handheld programmer to modify operation parameters
- PC interface to set parameters
- Automatic regenerative braking
- Control by 5K 3-wire potentiometer
- Control by central 0 potentiometer
- Protection against potentiometer failure
- Protection against MOSFETS short circuit
- Over-temperature protection
- Protection for potentiometer not in neutral position at start-up
- Battery voltage control to inhibit operation in case of under-voltage
- 2 outputs to control main contactor, timed power steering, electromagnetic brake or other functions
- 24V contactors for all battery voltages
- Coil overheating protection for outputs
- 5 inputs for auxiliary functions
- On-board fault code status LED
- Possibility to connect an external LED for remote fault code display
- Advanced communication protocol for integration into other control systems and displays
- Reverse polarity protection through main contactor
- Possibility to control the system by a PLC
- Compliance with EC standards

TECHNICAL SPECIFICATIONS

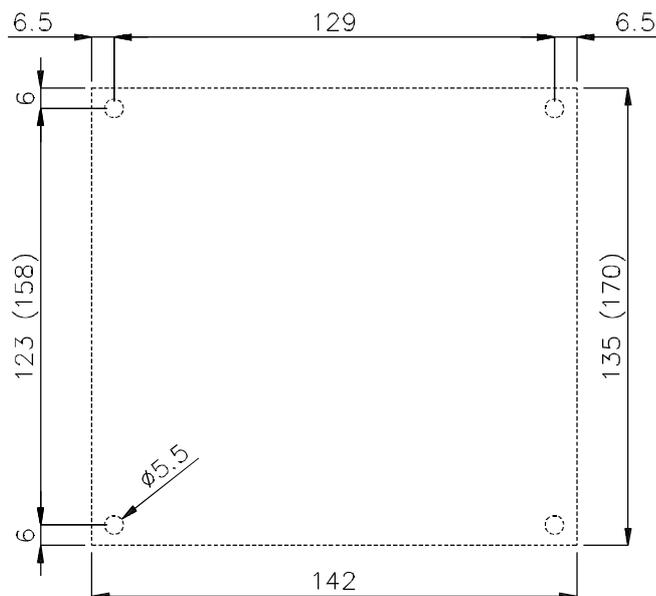
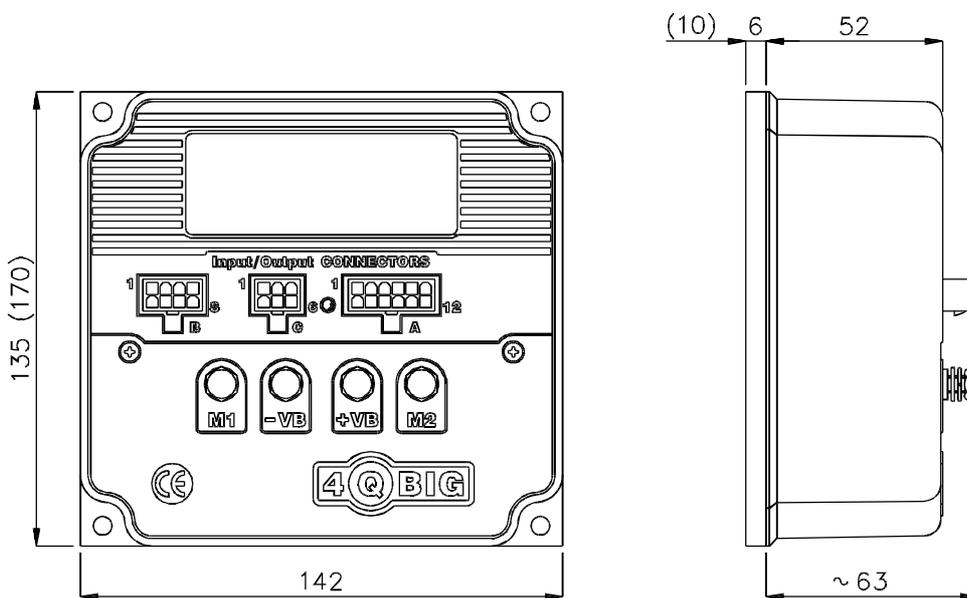
- Rated voltage from 24 to 48V
- Operation frequency 17 KHz
- Operation temperature -20°C/+40°C
- Thermal protection from 70 to 80°C

~~NEWS~~

MODELS AND DIMENSIONS

MODEL	4Q BIG 180	4Q BIG 300
VOLTAGE	24 - 48V	24 - 48V
PEAK CURRENT	180A	300 A
CURRENT for 1 min.	150A	250 A
CURRENT for 1 hour	50A	100 A

4Q BIG



WEIGHT	
4Q BIG 180	900 g
4Q BIG 300	1500 g

Fixing holes

*N.B. Da Specifications subject to change without notice
Dimensions in brackets are referred to the 4Q BIG 300 model*



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4Q COMBI

HIGH FREQUENCY CONTROL UNIT FOR 2 PERMANENT MAGNET MOTORS

4Q Combi bi-directional control units have been designed to control two permanent magnet dc motors.

Featuring the control of two independent motors, including complete counter-rotation, they are suitable for those vehicles equipped with two motors, such as aerial platforms, equipment for mobility aids, and vehicles operating in small areas.

No running and braking contactors are necessary, a full bridge power output stage provides reversing. The main contactor is necessary to guarantee insulation between control unit and battery in case of anomaly and to comply with safety standards.

The control unit features high frequency and regenerative braking at running control release and during reversal.

All parameters can be modified using a programmer or a package including a PC interface and a special program. The control unit is provided with two outputs to control power steering, brake and main contactor. All drivers are protected against coil overheating. 24V contactors can be used for all supply voltages, while for the brake contactor voltage depends on the battery.

MAIN TECHNICAL FEATURES

- Control unit for two permanent magnet dc motors.
- MOSFET technology and high frequency.
- Microprocessor control with circuitry self-diagnostics.
- Parameter setting through handheld programmer.
- Parameter setting through PC and interface card.
- Regenerative braking.
- Control through 5K three-wire potentiometer.
- Control through central 0 potentiometer.
- Control through joystick.
- Protection against potentiometer failure.
- Protection against MOSFET short circuit.
- Protection against overheating with proportional action.
- Protection against accidental start due to potentiometer not at 0 when the key is switched on.
- Supply voltage monitoring to stop operation in case of discharged battery.
- 2 output drivers to control main contactor, timed power steering, braking or other functions.
- 24V contactors for all battery voltage.
- Drivers with protection against coil overheating.
- 5 input lines for auxiliary functions.
- Trouble shooting through a flashing LED on the control unit.
- Possibility to add a remote LED for trouble shooting.
- Communication protocol to connect other control units or displays.
- Reverse polarity protection through main contactor.
- Control through PLC.
- Complies with CE standards.

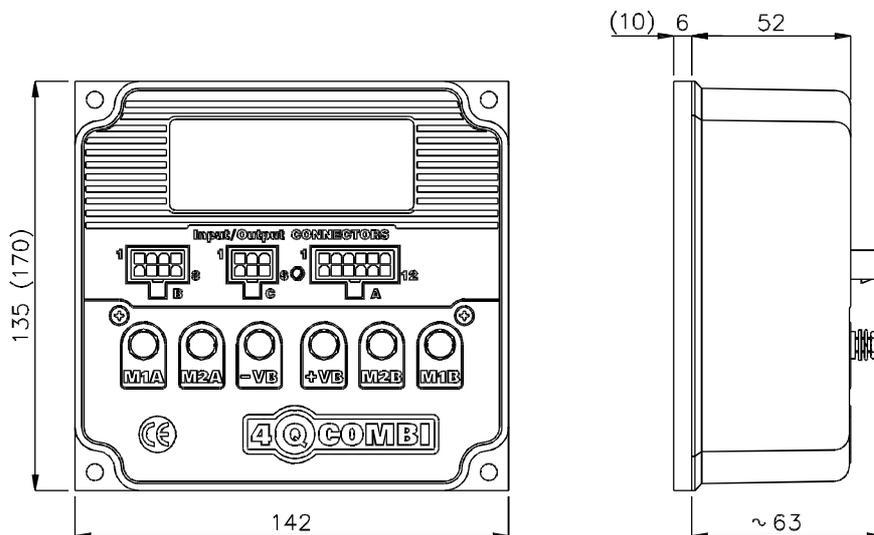
SPECIFICATIONS

- Voltage rating from 12 to 48V
- Operation frequency 17 KHz
- Operation temperature -20°C/+40°C
- Thermal limiter action from 70 to 80°C

~~NEWS~~

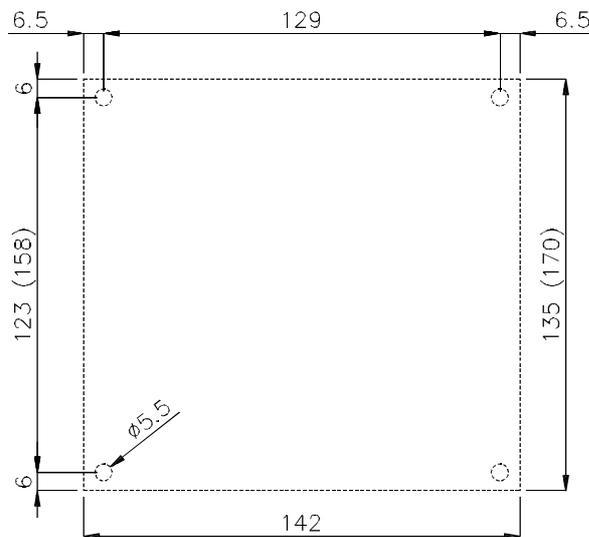
MODELS AND DIMENSIONS

MODEL	4Q COMBI 90		4Q COMBI 150	
MOTORS	Motor 1	Motor 2	Motor 1	Motor 2
VOLTAGE	12 - 24V / 36 - 48V	12 - 24V / 36 - 48V	24 - 48V	24 - 48V
PEAK CURRENT	90A	90A	150A	150A
CURRENT for 1 MIN.	83A	83A	150A	150A
CURRENT for 1 HOUR	35A	35A </td <td>50A</td> <td>50A</td>	50A	50A



4Q COMBI

Weight 900g

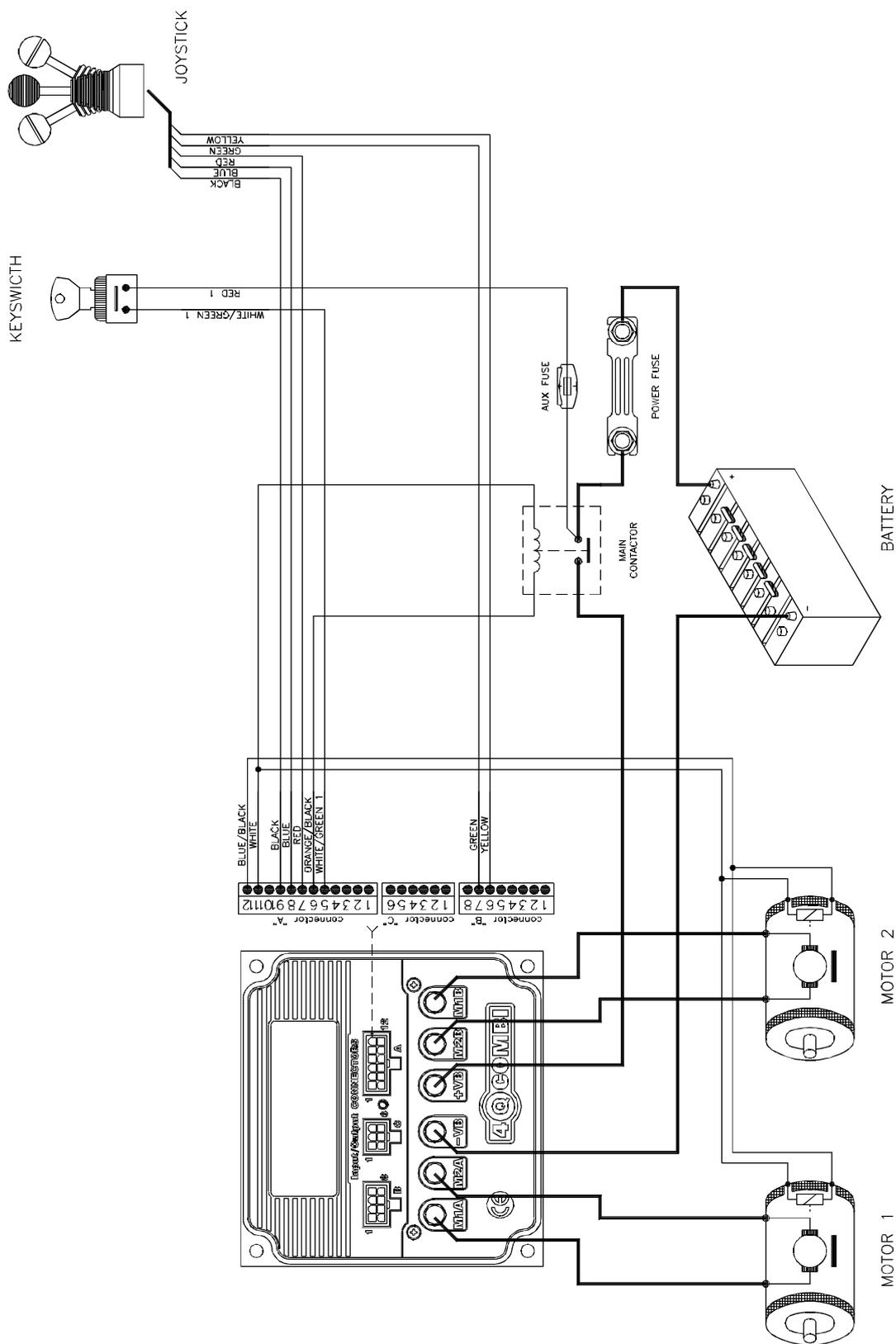


Fixing holes

Technical features subject to changes without notice.

NEWS

WIRING DIAGRAM





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TFI 4Q

HIGH FREQUENCY CONTROLLER FOR PERMANENT MAGNET MOTORS WITH REGENERATIVE BRAKING

TFI 4Q is a bidirectional high frequency controller designed to control DC permanent magnet motors. A MOSFET full bridge power section provides reversing with no need to use running contactors. The controller features regenerative braking acting when the running control is released and during reversing.

TFI 4Q is equipped with a main relay to guarantee insulation of the controller from the battery in emergency situations to meet the safety requirements in force.

A hardware and software fault detect system protects the equipment in case of over-current.

The controller can be used to control two potentiometers in a power steering system and offers the possibility to introduce a redundant power steering system to control 4 potentiometer signals.

Operation parameters can be modified by programmer or PC and serial interface.

3 LEDs indicate battery level. Auxiliary outputs are available to control 24V contactors with coil protection.

FEATURES

- Controller for DC permanent magnet motors
- MOSFET technology and high frequency operation
- Microprocessor control with self test of control circuitry
- Handheld programmer to modify operation parameters
- PC interface to set parameters
- Automatic regenerative braking
- Control by 5K 3-wire potentiometer
- Control by central 0 potentiometer
- Control by PLC
- Redundant control system for power steering
- Protection against potentiometer failure and MOSFETS short circuit
- Over-temperature protection
- Protection for potentiometer not in neutral position at start-up
- Over-voltage and under-voltage protection
- 3 outputs to control contactors
- 24V contactors for all battery voltages
- Coil overheating protection for outputs
- 5 inputs for auxiliary functions
- On-board fault code status LED
- Possibility to connect an external LED for remote fault code display
- Advanced communication protocol for integration into other control systems and displays
- Reverse polarity protection through main relay
- Compliance with EC standards

TECHNICAL SPECIFICATIONS

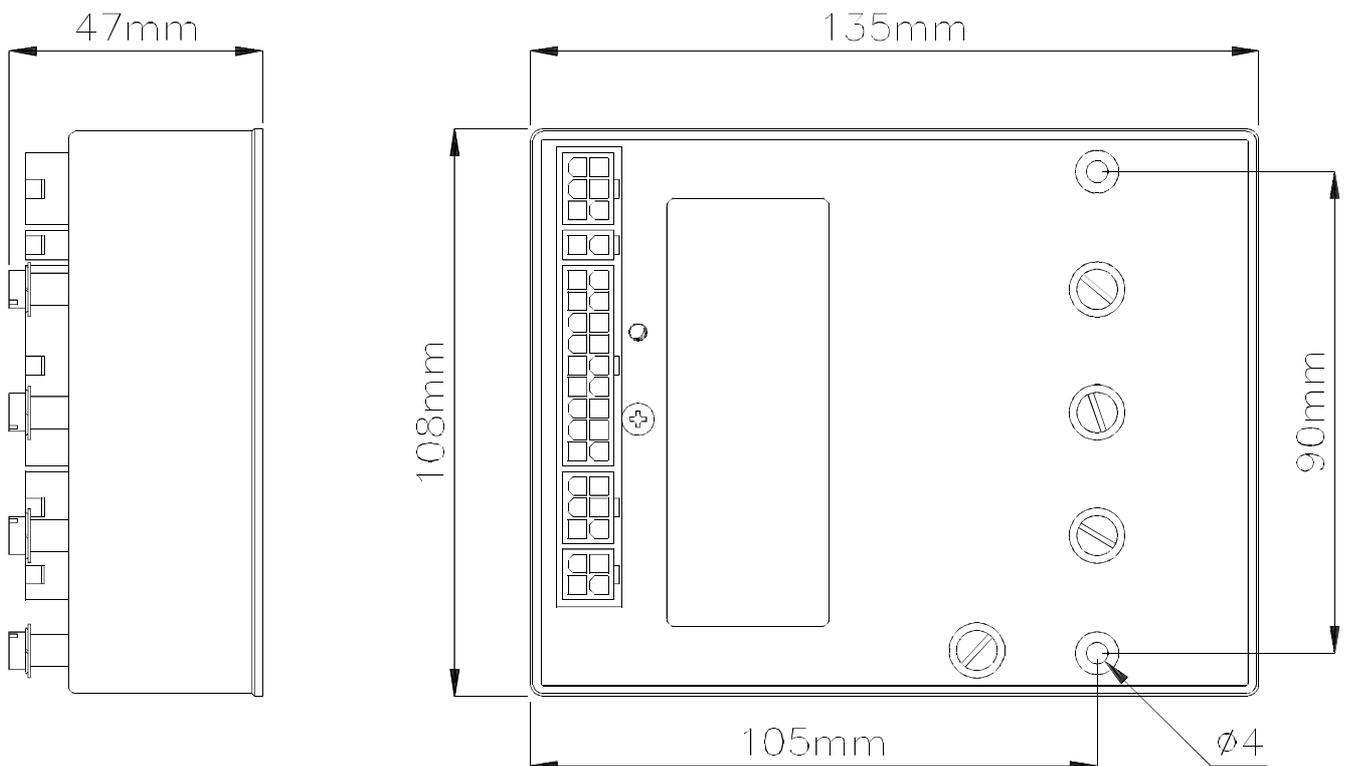
- Rated voltage from 12 to 48V
- Operation frequency 17 KHz
- Operation temperature -20°C/+40°C
- Thermal protection from 70 to 80°C

~~NEWS~~

MODELS AND DIMENSIONS

MODEL	TFI 4Q 140
VOLTAGE	12 - 48V
PEAK CURRENT	140A
CURRENT for 1 min.	121A
CURRENT for 1 hour	48A

TFI 4Q

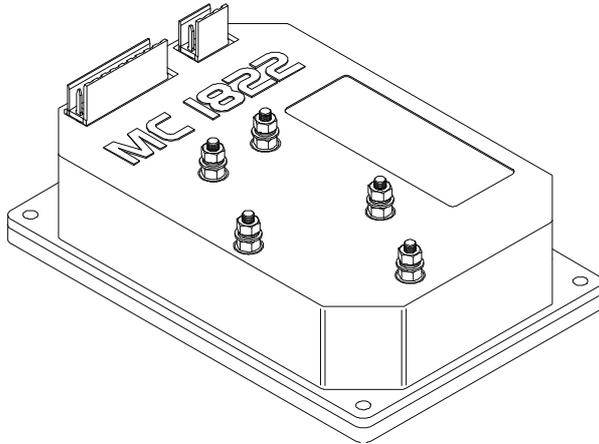


WEIGHT	
TFI 4Q 140	600 g

N.B. Specifications subject to change without notice



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MC-1822

HIGH FREQUENCY ELECTRONIC CONTROL UNIT

The bidirectional high frequency electronic control unit MC-1822 with automatic pedal release braking represents the newest range of DC-control units manufactured by ELEKTROSISTEM and aided by microprocessor.

This control unit has been designed for series excitation motors with 2, 3, or 4 terminals and built according to the mosfet technology in compliance with the most recent security provisions for the application on EC-vehicles. It is produced in a power range from 100A to 270A in the standard voltages 12, 24, 36 and 48V.

The acceleration adjusting device allows the vehicle to gradually and regularly reach the maximum speed. The current limiter enables the operator to adjust the max. current supplied

to the motor. This control unit is provided with a braking system acting by pedal release or during reverse that may be directly adjusted by foot accelerator. The max. braking value can be set by the operator according to his needs. The operation parameters of the vehicle may be entered and adjusted by connecting the control unit to the display type ITS that is even used for trouble shooting. The MC-1822 control unit is produced with high technology components such as high power and voltage mosfets, high frequency switching diodes, high power and temperature filter capacitors.

MAIN TECHNICAL FEATURES

- Control unit aided by microprocessor.
- Operation parameters adjustable through a programming display.
- Possibility to use the software and a PC interface instead of the display ITS.
- Slow starting through adjustable acceleration slope.
- Settable limiter of the max. current supplied to the motor.
- Proportional action thermal limiter.
- Braking system acting by pedal release and during reverse.
- Settable limiter of max. braking current.
- Control system by a 5K or a 10K potentiometer connected to 3 wires.
- Intervention of the safety block in case of short circuit of the mos units.
- Intervention of the safety block in case of potentiometer breakdown.
- Intervention of the safety block when, turning the key, the potentiometer is not on the value 0.
- Disabling of the safety block by resetting the potentiometer to the value 0.
- Anti-rollback function.
- Driver for the control of an electromagnetic brake or for the connection of a second speed.

TECHNICAL SPECIFICATIONS

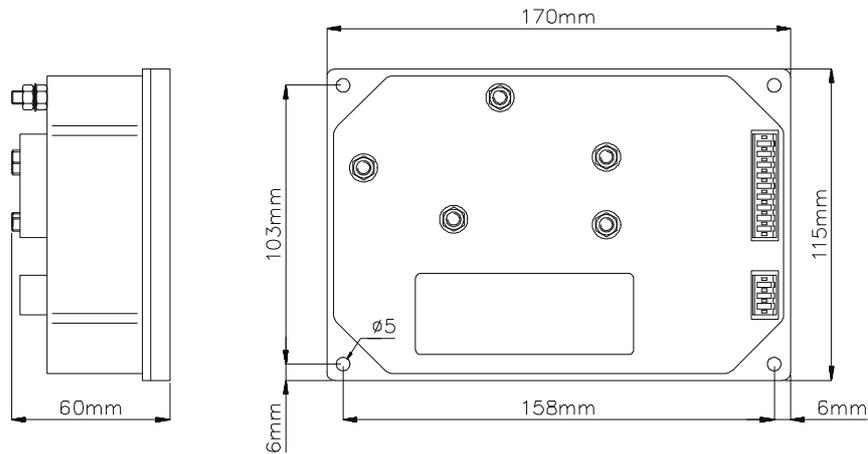
- Voltage rating	12-24-36-48V
- Max. nominal current	100A-270A
- Allowed power supply variation	from 85% to 125%
- Operation frequency	17 KHz
- Operation temperature	-20°C/+40°C
- Humidity at 25°C	90%
- Thermal limiter action	from 70°C to 80°C
- Weight	750 gr.

~~NEWS~~

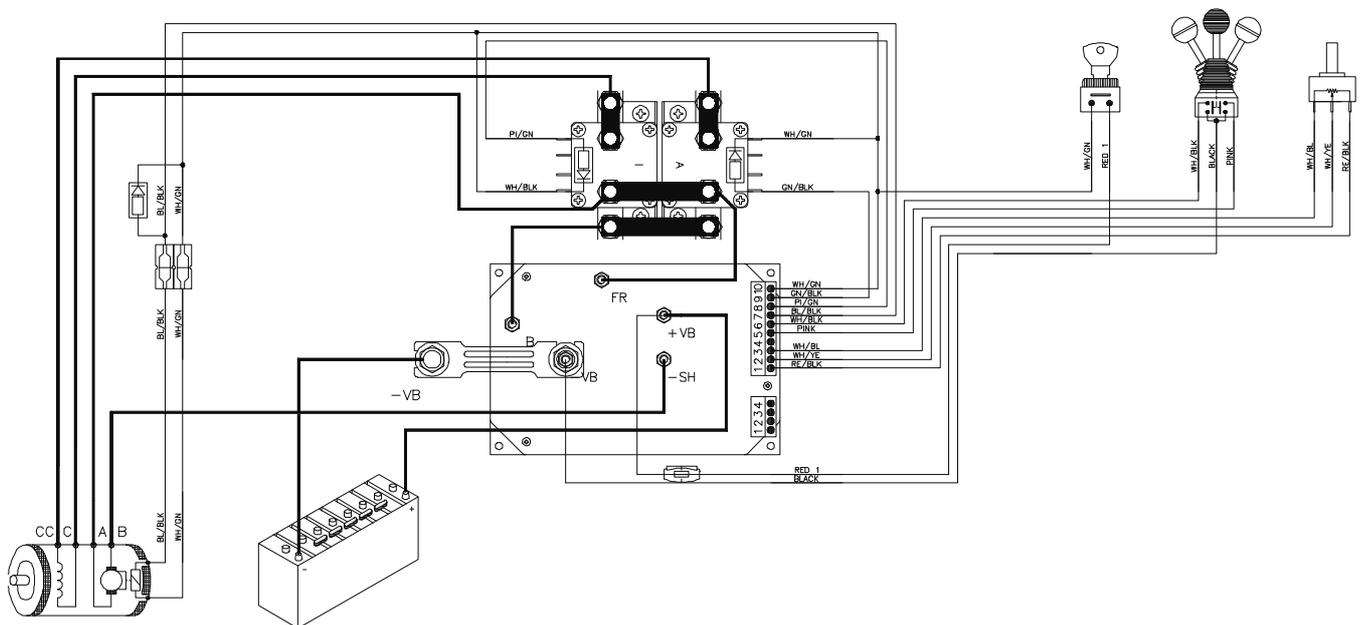
MODELS

Size	Voltage				Starting Current	Current/Min	Current/Hour
	12 V	24 V	36 V	48 V			
100 A				*	100 A	85 A	40 A
140 A				*	140 A	120 A	55 A
160 A	*	*	*		160 A	135 A	65 A
180 A				*	180 A	155 A	70 A
220 A	*	*	*		220 A	190 A	85 A
270 A	*	*	*		270 A	230 A	100 A

DIMENSIONS



CONNECTION DIAGRAM





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MC-40B/BR MC-60B/BR

HIGH FREQUENCY CONTROL UNIT

MC-40B and MC-60B high frequency, bidirectional electronic control units are aided by microprocessor and can perform automatic pedal release braking. They have been conceived for series excited motors with 2, 3 or 4 terminals and can perform reverse current braking or regenerative braking. Built according to the *MOSFET* technology and in compliance with security directives for use on CE marked vehicles, these control units represent a brand new product joining the wide range of units manufactured by ELEKTROSISTEM. Acceleration setting allows the vehicle to gradually reach ma-

ximum speed. The current limiting device enables the operator to set the maximum current supplied to the motor.

Braking acts at pedal release and during reverse and can be set by the accelerator pedal. Maximum braking current can be set by the operator according to the use.

MC-40B ed MC-60B control units have been manufactured with high technology components such as high power and voltage MOSFETs, high frequency switching diodes and high power and temperature filter capacitors.

MAIN TECHNICAL FEATURES

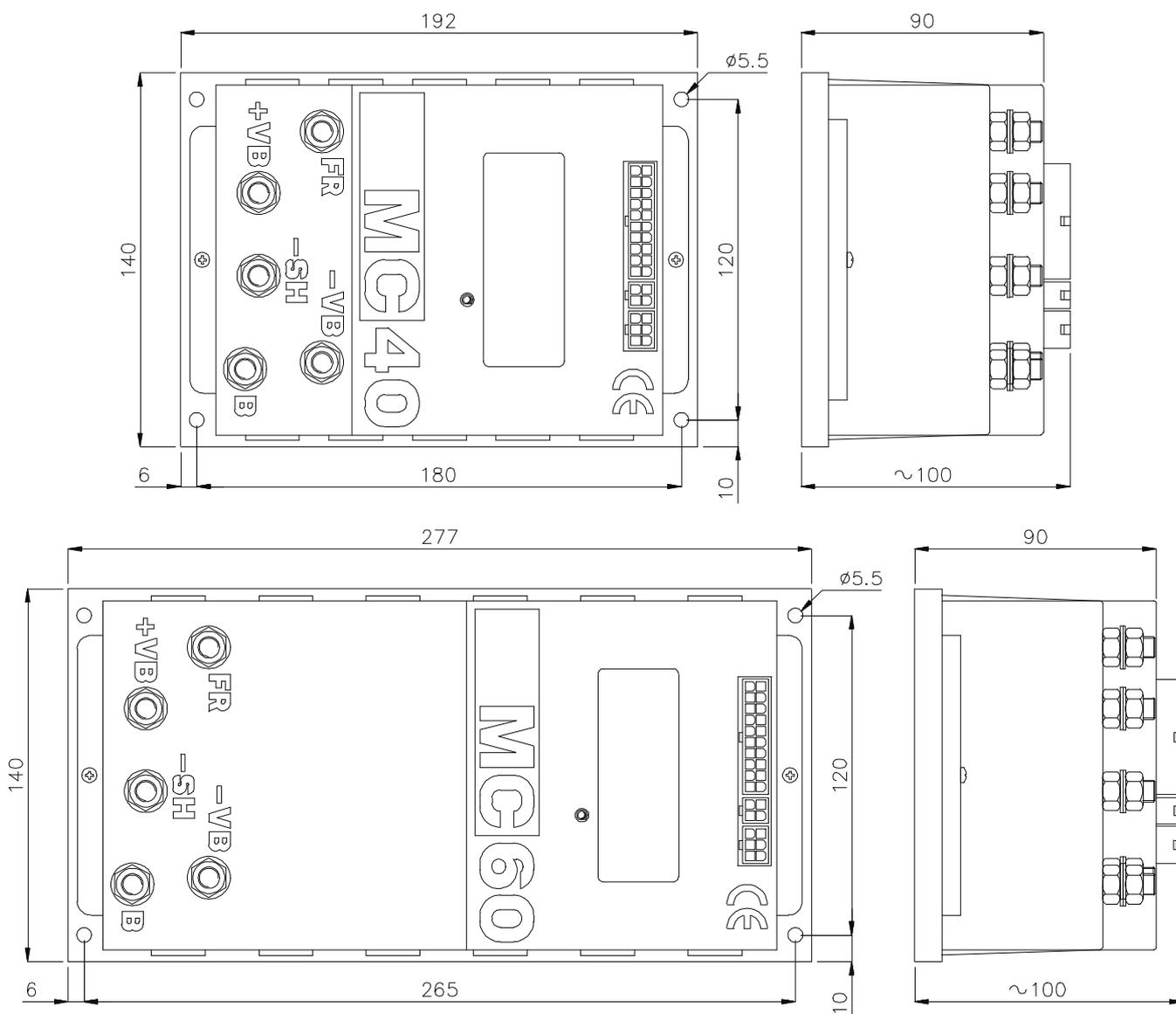
- Control unit aided by microprocessor.
- Reverse current braking or regenerative braking.
- Adjustable operating voltage (24-36-48-60-72-80-96 volts).
- Parameter programming by PC and RS-2001 interface.
- Speed control by 5K three-wire potentiometer.
- Potentiometer min. and max. current adjustable.
- Control by central 0 potentiometer.
- Control by PLC.
- Slow starting through adjustable acceleration slope.
- Current limit in case of overheating.
- Braking at accelerator release and during reverse, and braking current increase by brake pedal.
- Operation frequency 17KHz.
- Error file.
- Max. speed for forward and reverse adjustable.
- Outputs with coil overheating and reverse polarity protection for:
 - Forward contactor.
 - Reverse contactor.
 - Regenerative braking contactor / main contactor.
- Outputs with reverse polarity protection for:
 - 1st weakening contactor.
 - 2nd weakening contactor / power steering contactor / brake contactor.
- Three auxiliary inputs available for:
 - Pedal brake / emergency reverse.
 - Seat switch / tiller switch / parking brake switch.
 - Speed reduction.
- 0-5 volt analogue input with adjustable value.
- Error LED.
- Protection against reverse polarity, motor overloads or short circuits, wires or potentiometer cut off or breaking, wrong battery voltage, high temperature and defective coil or contact and in case of unit failure.

~~NEWS~~

MODELS

Model	Size	Voltage	Peak current	Current for 1 min.	Current for 1 hour
MC-40B MC-40BR	400A	24/80V	400A	340A	130A
MC-41B MC-41BR	360A	84/96V	360A	300A	100A
MC-48B MC-48BR	400A	24/48V	600A	500A	130A
MC-60B MC-60BR	600A	24/80V	600A	530A	200A
MC-61B MC-61BR	550A	84/96V	550A	480A	160A

DIMENSIONS

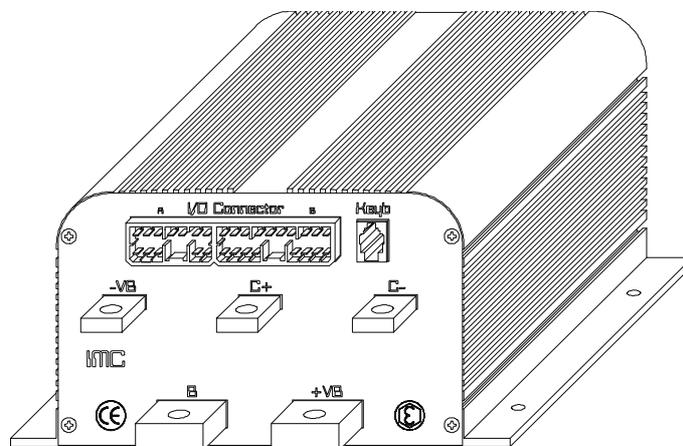




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INTELLIGENT MOSFET CHOPPER "IMC"



OPEN SYSTEM

The new line of control units manufactured by ELEKTROSISTEM has been designed according to recent developments, that have led to the application of the microprocessor in every sector of electronics. The chopper implemented by ELEKTROSISTEM is not only a microprocessor aided chopper, but a real control equipment representing the new generation of DC control systems.

The basic principle of this unit is to be found in the so-called "OPEN SYSTEM", that is a system with a variable configuration composed of 1 up to 3 elements:

- Traction controller type IMC T
- Pump controller type IMC P
- Graphic display type IGS

Each element can be connected with the other components of the "chain" through a double-wire serial line, to allow an interchange of data and functioning synchronism. These units have been devised and configured to interact among them to create an "open system", but at the same time are independent and can work even if not connected to the other elements of the new intelligent line created by ELEKTROSISTEM.

VERSATILITY

The most important advantage coming from the use of a microprocessor aided logic is the possibility to control on the same HARDWARE different functions, that can be rapidly adjusted for special applications.

The IMC chopper can be used with series excited motors with 2 or 4 terminals, braking may be modulated by running controls and may be regenerative (only for motors with 4 terminals) or reverse current.

The model IMC POWER 2 has been specially conceived to control 2 series excited motors with the function of "electronic differential" as it is provided with an input for position absolute encoder or potentiometer to determine the position of steering wheels. According to the measured steering angle, the chopper can decrease the power supplied to the motor

controlling the internal wheel of the vehicle and even reverse its rotation, for reduced bending radius.

The accelerator potentiometer is available with 2 or 3 wires, with a value included from 1 and 10 Kohm. The potentiometer adjustment is "read" and permanently recorded by the logic microprocessor. This avoids long and complicated setting operations and those problems concerned with non-perfectly centered potentiometers.

Moreover, the IMC chopper is able to control the motor speed through a speedometer dynamo or a pulses rev. transducer.

SAFETY AND RELIABILITY

The "IMC" has been specially designed by ELEKTROSISTEM's electronic engineers to offer the operator safety working conditions and to avoid the immediate stop of the vehicle in case of temporary anomaly. This has so far represented quite a hindrance, inducing the operator to prefer a "stupid system".

The intelligent chopper IMC is equipped with a logic that constantly checks the internal power section as well as external actuators. In this way the chopper running is stopped only in case of events that may be dangerous for the operator's safety (i.e. MOSFET short circuit, control potentiometer blocked at max. value, etc.). On the contrary, in case of "not serious" anomalies (short circuit or damage of the coil of a weakening field contactor, that could only limit the max. speed of the motor) the logic signals the irregularity on the IGS display or by means of an intermittent led.

Many other inputs are available for further safety signals, including:

- operator presence on the vehicle
- dead man function
- speed reduction (ex. to slow down running with forks up)
- hand brake.



The safety system is moreover integrated with a series of protections:

- proportional control of the max. current, when the heatsink reaches 70°C
- protection against short circuit of contactor drivers
- protection against motor overload or short circuit
- protection against polarity reversal by means of an external contactor.

SIMPLE FUNCTIONING

The IMC control unit has been devised to completely interact with the graphic display type IGS to offer the operator a complete understanding of the system functioning. Processes, numerical data and possible anomalies are visualised and explained through the IGS display, which combines three important elements:

- simple functioning (no numerical codes to understand how the system operates)
- exhaustive information (in the desired language)
- synthesis.

GENERAL FEATURES

- Parameters adjustment by keyboard
- Safety code to enter adjusting function
- Possibility to program more units with the same adjusting parameters
- Hour meter and battery charge control inside the logic or synchronized with the IGS display (if present)
- Automatic recording of working hours and conditions of the vehicle in case of breakdowns, for a simple anomaly diagnosis
- Malfunctioning file
- Real time chopper monitoring (only with IGS display)
- Possibility to drive the vehicle by means of remote controls
- Control of up to 5 contactors with programmable functions for the model with a single motor:
 - Forward running function
 - Backward running function
 - Regenerative braking or line function
 - Field weakening or bypass function
 - 2nd field weakening function or activation of the hydraulic steering motor
- Control of up to 6 contactors with programmable functions for the model POWER 2, i.e. with 2 motors:
 - LH Forward running function
 - LH Backward running function
 - RH Forward running function
 - RH Backward running function
 - Regenerative braking function
 - Contactor for field weakening or activation of the hydraulic steering motor
- Electrically insulated case
- Retroaction of the motor speed by means of a speedometer dynamo or a proximity sensor

TECHNICAL SPECIFICATIONS

Rated current	400A - 600A - 800A - 1000A
Multivoltage	from 24 to 80V or from 96 to 144V (-33% +20%)
Operation frequency	15800 Hz
Max. ambient temperature	-20 +40°C
Relative humidity at 25°C	90%
Thermal limiter action	from 70 to 80 °C

TECHNOLOGY

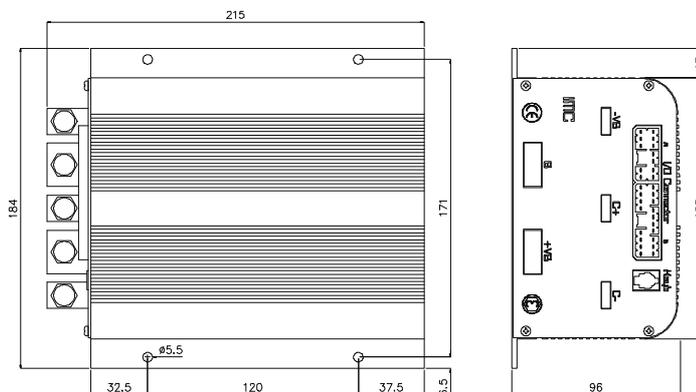
The IMC chopper has been designed and built with high technology components, such as high voltage and high current MOSFETs, high frequency switching diodes able to stand 100% overloads, filter capacitors for high current and temperature. All components are assembled inside a strong specially shaped aluminium case allowing a rapid heat disposal.

Every single electronic component is automatically tested by a computer aided device (Automatic Test Equipment) to check the quality of the finished product before the power test.



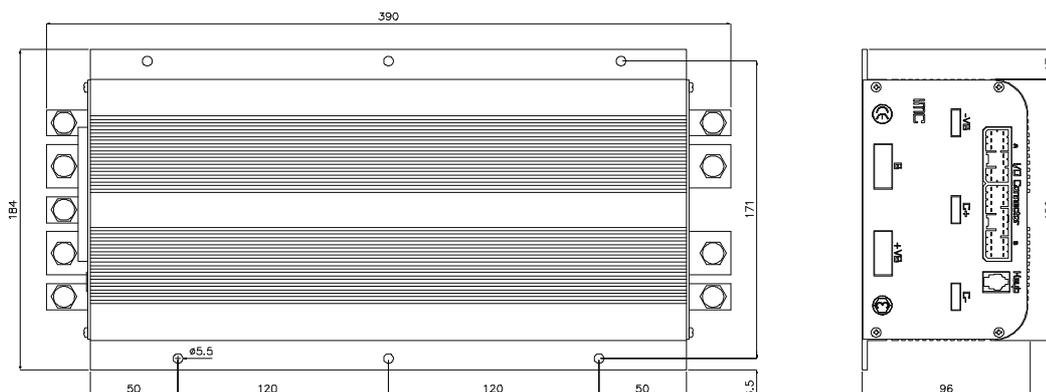
MODELS, SIZE AND FIXING HOLES

IMC



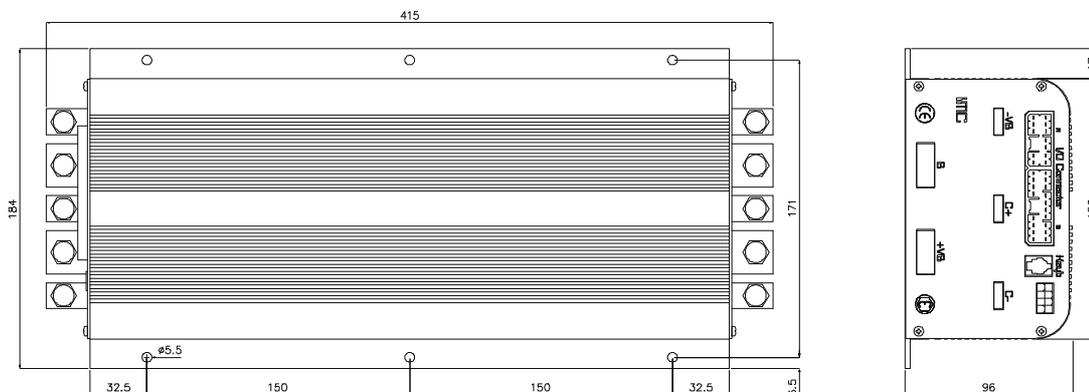
IMC	400 A	600 A
24 / 80 V	IMC 40	IMC 60
96 / 144 V	IMC 41	IMC 61

IMC 100



IMC 100	800 A	1000 A
24 / 80 V	IMC 80	IMC 100
96 / 144 V	IMC 81	IMC 101

IMC POWER2



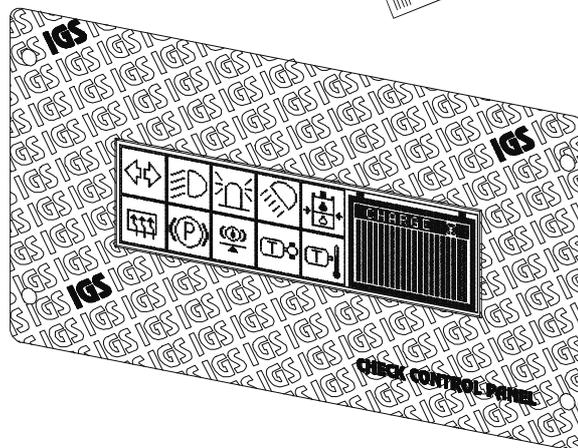
IMC POWER2	400 + 400 A	600 + 600 A
24 / 80 V	IMC 40 POWER2	IMC 60 POWER2
96 / 144 V	IMC 41 POWER2	/



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INTELLIGENT GRAPHIC SYSTEM "IGS"



The IGS (Intelligent Graphic System) represents the newest stage in the evolution of data display systems and the definitive overcoming of the traditional dashboard.

The microprocessor technology combined with the great versatility of a graphic display makes this unit one of the most efficient control systems that enables the operator to constantly monitor the functioning of his vehicle. The innovation of the system consists in the

introduction of an "intelligent dashboard" which acts as a real control unit ensuring a number of different applications, as single instrument, as graphic interface and integral part of the MOS microprocessor logic.

Actually, the IGS display gives its highest performance when used with the chopper unit, representing a constant and precise control device that can be personalized according to the specific operator's requirements.

Versatility is the secret of the IGS unit which has been conceived as a graphic "blackboard" made up of thousands of points with a resolution lower than 0.5 mm that offers numberless drawing possibilities and a complete layout personalization.

As a real display terminal it can be used even for anomalies signalling and trouble shooting.

MAIN FEATURES

- Microprocessor aided control unit
- Graphic display: 256x64 dot
- Graphic resolution: 0.44 mm
- Graphic area dimensions: mm 120 x 30
- Back lighting
- Total graphic and operation personalization
- Interface with MOS IMC microprocessor aided control unit through a simple serial connection
- Input for programming keyboard
- Output with relay for hydraulic function block
- Signalling buzzer

CONFIGURATION

Display

- Hourmeter indication / enabling
- Battery charge percentage indication with "reserve" signalling when charge goes beyond a pre-set threshold that can be fixed according to personal requirements (ex. 10%)
- Graphic display of the different functions (lights, enabled running control, hand brake, etc.) and anomaly conditions (worn-out brushes, overheating, brake damage, etc.)
- Display of the stored maintenance program according to hourmeter indication

Display + Chopper

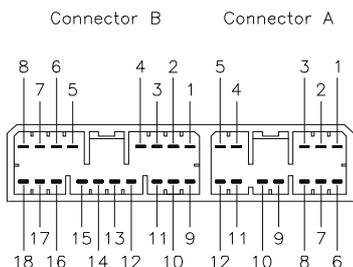
- Adjustment and check of the chopper working parameters
- Detailed and precise report of dangerous and malfunctioning situations
- Operation values tester

~~NEWS~~

TECHNICAL FEATURES

- Battery values: 48V - 60V - 72V - 80V - 96V (and on request any value ranging from 24V to 144V)
- Ambient temperature: 0°C +40°C
- Humidity: 90% at 25°C

CONNECTIONS



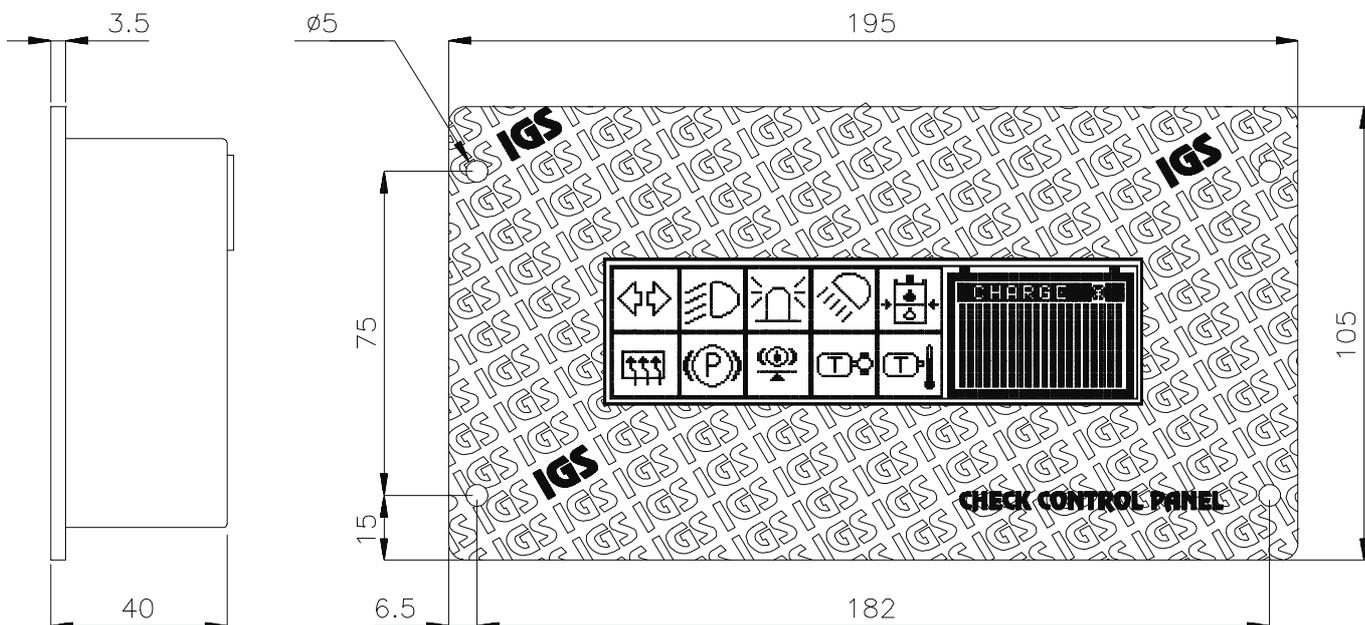
CONNECTOR A	
1A	- VB
2A	Relay for lifting block
3A	-
4A	Traction motor brushes wear
5A	Pump motor brushes wear
6A	+VB
7A	N.C. contact for lifting block relay
8A	N.O. contact for lifting block relay
9A	-
10A	-
11A	Clogged oil filter
12A	Heated rear window

CONNECTOR B	
1B	Brake liquid level
2B	Direction indicators
3B	Dimmers
4B	Oil level
5B	-TXD Serial transmission
6B	+TXD Serial transmission
7B	- RXD Serial reception or diagnostic led signal input
8B	+ RXD serial reception or diagnostic led signal input
9B	Hand brake
10B	Brake failure*
11B	Running lights
12B	Additional light
13B	Flash light
14B	Pump motor overheating*
15B	Traction motor overheating*
16B	Hourmeter enabling
17B	-
18B	-

IMPORTANT !!! Do not connect free pins, this may damage the equipment.

* Inverted logic

SIZE AND FIXING HOLES





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PHOENIX HIGH FREQUENCY CONTROL UNIT FOR SEPARATELY EXCITED MOTORS

OPEN SYSTEM

The new line of control units manufactured by ELEKTROSISTEM has been designed according to recent developments, that have led to the application of the microprocessor in every sector of the electronics. The new control unit is not only a microprocessor aided chopper, but a real control equipment representing the new generation of DC control systems.

The basic principle of this unit is to be found in the so-called "OPEN SYSTEM", that is a system with a variable configuration composed of 1 up to 3 elements:

- Traction controller type PHOENIX T
- Pump controller type IMC P
- Graphic display type IGS

Each element can be connected with the other components of the "chain" through a double-wire serial line, to allow an interchange of data and functioning synchronism. These units have been devised and configured to interact among them to create an "open system", but at the same time are independent and can work even if not connected to the other elements of the new intelligent line created by ELEKTROSISTEM.

VERSATILITY

The most important advantage coming from the use of a microprocessor aided logic is the possibility to control on the same HARDWARE different functions that can be rapidly adjusted for special applications.

The potentiometer has a value included between 1 and 10 Kohm. The potentiometer adjustment is "read" and permanently recorded by the logic microprocessor. This avoids long and complicated setting operations and those problems concerned with non-perfectly centered potentiometers.

Moreover, the phoenix control unit is able to control the motor speed through a pulses rev. transducer.

SAFETY AND RELIABILITY

The phoenix control unit has been specially designed by ELEKTROSISTEM's electronic engineers to offer the operator safety working conditions and to avoid the immediate stop of the vehicle in case of temporary anomaly. This has so far represented quite a hindrance, inducing the operator to prefer a "stupid system".

The logic constantly checks the internal power section and external actuators. In this way the chopper running is stopped only in case of events that may be dangerous for the operator's safety (i.e. MOSFET short circuit, control potentiometer blocked at max. value, etc.), while in case of "not serious" anomalies the logic signals the irregularity on the IGS display or by means of an intermittent led.

Many other inputs are available for further safety signals, including:

- operator presence on the vehicle
- speed reduction (ex. to slow down running with forks up)
- hand brake.

The safety system is moreover integrated with a series of protections:

- proportional control of the max. current when the heatsink reaches 70°C
- protection against short circuit of contactor drivers
- protections against motor overload
- protection against polarity inversion by means of an external contactor.



SIMPLE FUNCTIONING

The Phoenix control unit has been devised to completely interact with the graphic display IGS to offer the operator a complete understanding of the system functioning. Processes, numerical data and possible anomalies are visualised and explained through the IGS display, which combines three important elements:

- simple functioning (no numerical codes to understand how the system operates)
- exhaustive information (in the desired language)
- synthesis.

TECHNOLOGY

The Phoenix control unit has been designed and built with high technology components, such as high voltage and high current MOSFETs, high frequency switching diodes able to stand 100% overloads, filter capacitors for high current and temperature. All components are assembled inside a strong specially shaped aluminium case allowing a rapid heat disposal.

Every single electronic component is automatically tested by a computer aided device (Automatic Test Equipment) to check the quality of the finished product before the power test.

SPECIFICATIONS AND ADVANTAGES

The high frequency control guarantees higher performances both for the unit and for the battery that operate with continuous and not pulse currents with smaller losses for Joule effect.

The full bridge control of the motor field allows reversing without the use of direction contactors.

The main contactor guarantees the insulation of the control unit from the battery during emergency situations or when the key is disabled.

Recovery braking enables a high braking couple with limited armature currents reducing brush wear and motor heating.

APPLICATION

The Phoenix control units have been designed for the drive of separately excited motors and are divided into Phoenix T60 suitable for motors from 4.8 Kw to 16 Kw and Phoenix T80 suitable for motors from 12 Kw to 25 Kw for 24-80 V, and Phoenix T61 suitable for motors up to 19.2 Kw and Phoenix T81 suitable for motors up to 25.6 Kw for 96 V and T82 for 120V.

GENERAL FEATURES

- Parameters adjustment by programming terminal.
- Safety code to enter adjusting functions.
- Possibility to program more units with the same adjusting parameters.
- Hour meter and battery charge control inside the logic or synchronized with the IGS display (if present).
- Automatic recording of working hours and conditions of the vehicle in case of breakdowns, for a simple anomaly diagnosis.
- Malfunctioning file.
- Real time control unit monitoring (only with IGS display).
- Possibility to drive the vehicle by means of remote controls.
- Control of 2 contactors with programmable functions:
 - Main Contactor
 - Contactor for power steering motor.
- Electrically insulated case.
- Retroaction of the motor speed by means of a proximity sensor.

TECHNICAL SPECIFICATIONS

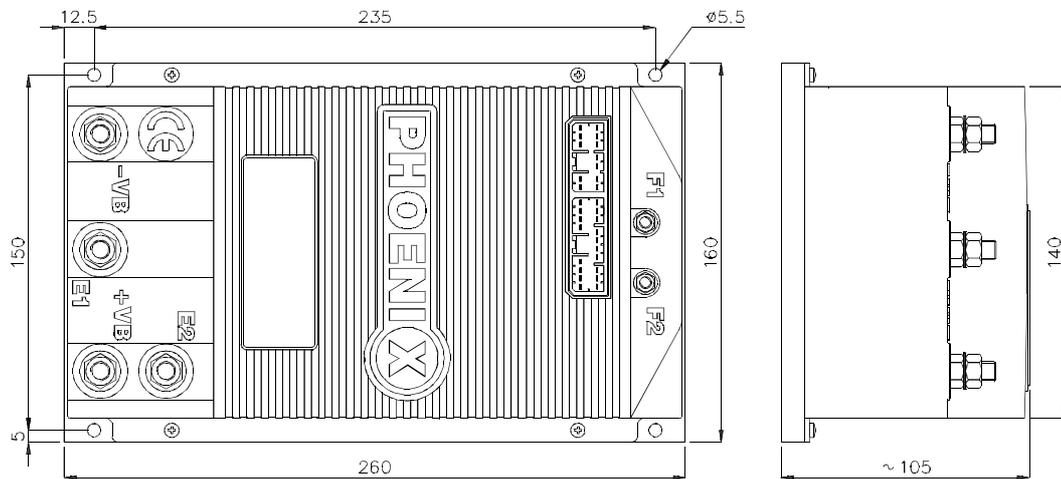
Rated current	600A - 800A
Multivoltage	24 / 80V or 96V or 120V (-33% +20%)
Operation frequency	15800 Hz or 7900 Hz for 120V
Max. ambient temperature	-20 +40°C
Relative humidity at 25°C	90%
Proportional action thermal limiter	from 70 to 75 °C
Weight	4.5 Kg (Phoenix T60/T61) - 6 Kg (Phoenix T80/T81/T82)



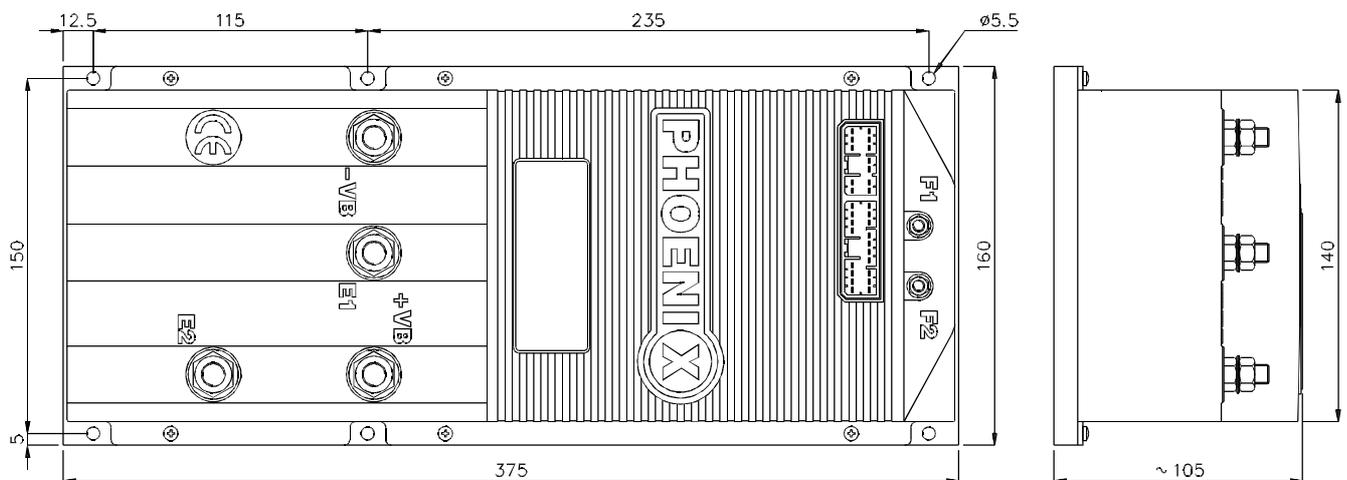
MODELS AND MECHANICAL CLERANCE

Model	Size	Operation Voltage	Starting Current	Current supplied for 1 minute	Current for 1 hour	Max. Field Current
Phoenix T60	600A	24-80V	600A	600A	200A	60A
Phoenix T61	600A	96V	600A	600A	200A	60A
Phoenix T80	800A	24-80V	800A	800A	350A	80A
Phoenix T81	800A	96V	800A	800A	350A	80A
Phoenix T82	800A	120V	800A	800A	350A	80A

PHOENIX T60/T61



PHOENIX T80/T81/T82



*N.B. All models meet EC requirements.
Specifications subject to change without notice.*





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SECU

HIGH FREQUENCY CONTROL UNIT FOR SEPARATELY EXCITED MOTORS

SECU bidirectional and high frequency electronic control units have been designed for separately excited DC motors. No direction and braking contactors are necessary, a MOSFET full bridge control allows for reversing. The main contactor guarantees the insulation from the battery in emergency situations and complies with safety requirements.

The possibility to separately control motor windings enables a smooth and seamless control of the motor and can optimize vehicle performance.

The unit also features regenerative braking at pedal release and during reverse.

All parameters can be modified using a simple programming keyboard or by PC using a special interface and software.

Outputs for main contactor, power steering and braking are available. All drivers are equipped with economizer function to avoid coil overheating. Contactors at 24V are to be used for all models, independently from supply voltage, while for electromagnetic brake, voltage depends on the battery.

GENERAL FEATURES

- Control unit for separately excited DC motors.
- MOSFET technology and high frequency for the control of both field and rotor.
- Microprocessor control and self test of drive circuits.
- Running parameters setting by means of programming keyboard.
- Possibility to program the unit by PC using a special interface.
- Regenerative braking at pedal release and during reverse.
- Control by three wires 5K potentiometer.
- Possibility to control the unit using a central 0 potentiometer.
- Protection against potentiometer failure.
- Protection against MOSFET short circuit.
- Protection against overheating of the unit.
- Protection against accidental start of the vehicle due to potentiometer not at 0.
- Undervoltage protection.
- Contactors at 24V independently from battery voltage.
- 2 or 3 output drivers for main, power steering, braking or other contactors.
- Drivers with economizer function to avoid contactor coil overheating.
- 5 inputs for auxiliary functions.
- Error signalling by means of a LED fitted on the unit.
- Possibility to connect an external LED for error signalling.
- Advanced communication protocol for connection with other units or with a display.

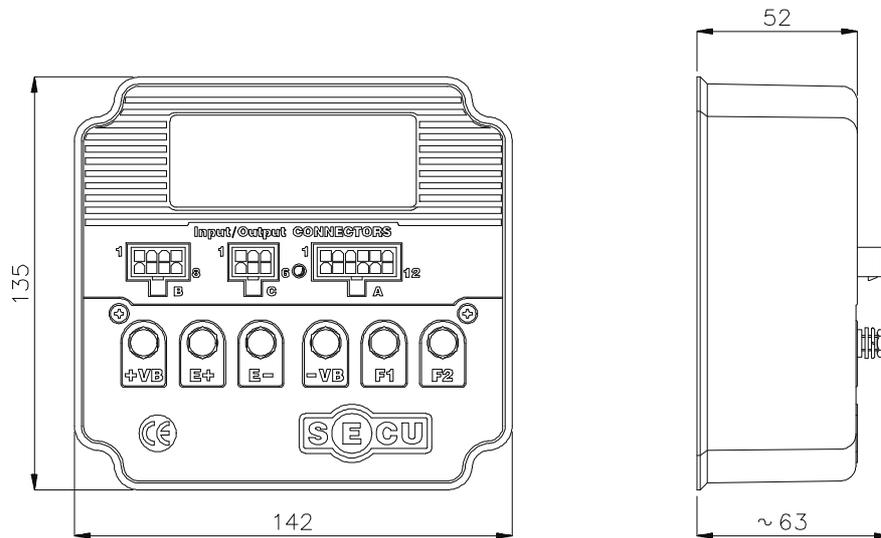
TECHNICAL SPECIFICATIONS

- Running voltage from 12V to 80V
- Running frequency (rotor/field) 17 KHz
- Running temperature -20°C/+40°C
- Thermal limiter action from 70 to 80°C

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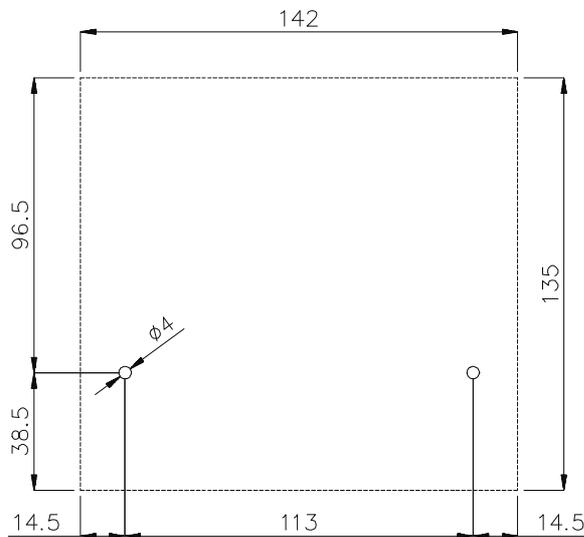
MODELS AND DIMENSIONS

MODEL	FIELD CURRENT	ROTOR CURRENT	VOLTAGE
SECU10 160/25	25A	160A	12-48V
SECU10 220/40	40A	220A	12-36V
SECU20 200/25	25A	200A	24-80V
SECU20 350/50	50A	350A	24/48V
SECU40 400/50	50A	400A	24-80V
SECU40 600/70	70A	600A	24-48V



SECU10

Weight 900g

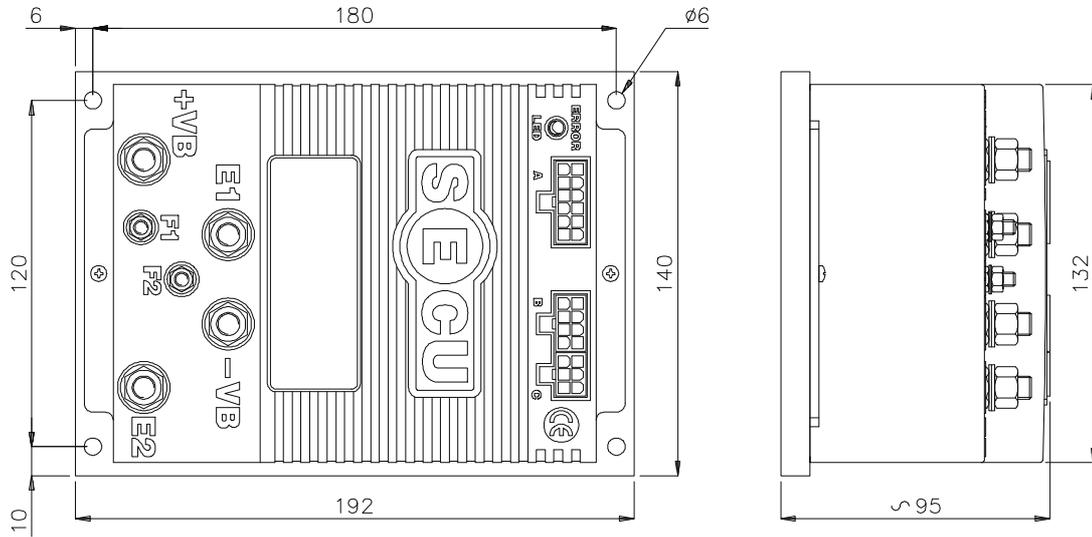


Fastening holes

Technical data subject to changes without notice.

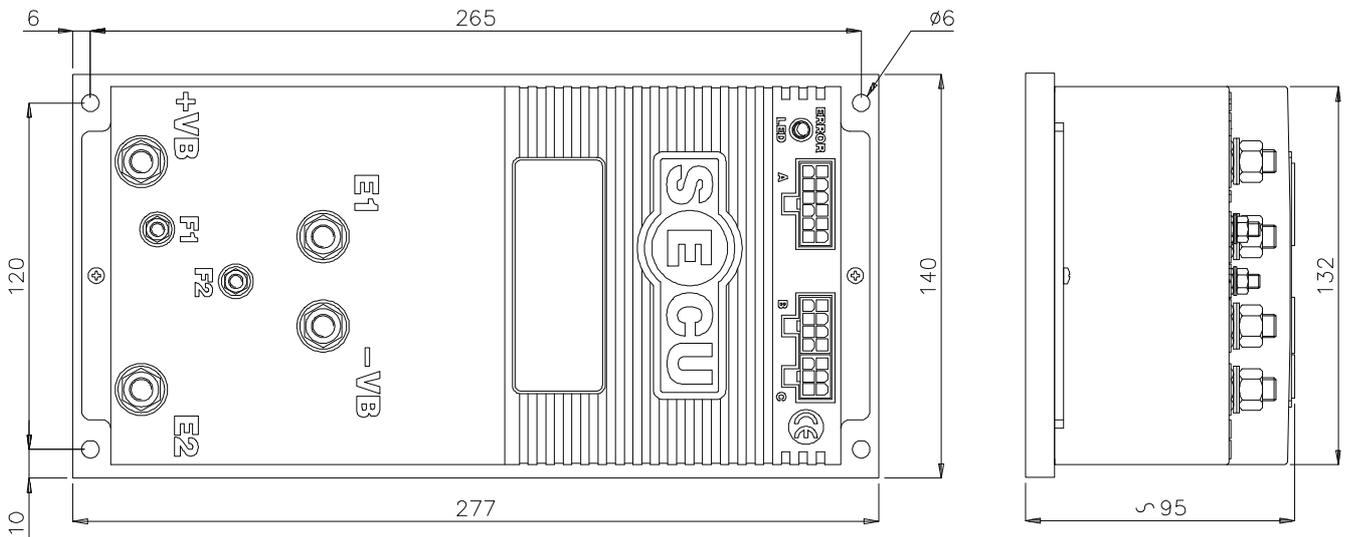
~~NEWS~~

SECU20



Weight 2.5Kg

SECU40



Weight 3.5Kg

Technical data subject to changes without notice.



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TRACTION CHOPPER AND POWER MODULE TYPE “SYSTEM-MOS”

The brand SYSTEM-MOS has been chosen by Elektro-sistem for a new line of control units characterised by a completely new power technology able to guarantee functionality, operator's safety as they are manufactured in conformity with the EEC standard No. 86/663 of 22-12-86 and a reliability never reached by the older “bipolar transistor technology”.

Assembled as “power modules”, that is complete with contactors, these control units introduce a new concept of electronic drive units for lift trucks.

For the operators facing every day the technical problems of this sector, this line represents without doubt a very good solution.

FUNCTIONALITY

The philosophy of the power module has recently developed among the foreign producers of chopper equipment, as it offers many economic and technical advantages, such as:

a) economy of the regulation system obtained by means of the integration of the electromechanical part with the electronic one, with the consequent elimination of wiring harness, and therefore of assembly and storage costs.

b) functionality of the power module system thanks to the rigorous space organization, the total elimination of electric connection by cable that very often causes loss of power and electromagnetic interference, the elimination of overheating and malfunctioning problems (difficult to locate) and, last but not least, the neat aesthetics that makes modules inspection easy.

RELIABILITY

The System-Mos “power module” is totally protected against battery polarity reversal and is extremely resistant to adverse working conditions and to human errors as no harness is necessary. It can stand motor short circuits in a continuous way and does not get overheated thanks to a thermal self-control system that acts on the max. overload current without limiting the vehicle's running. During maintenance and repair of a power module even contactors are controlled as they are part of the unit and therefore subjected to the same guarantee terms of the electronic part. On the contrary, a simple replacement of the controller could not solve the problem if the malfunctioning is due to contactors. The “power module” enables the operator to solve technical problems even by phone, as it represents a great proportion of the entire power apparatus of an electrical vehicle and can be easily replaced even by non-specialised personnel. It can be easily isolated from the auxiliary unit by means of a check connector that simulating all functions, enables immediate detection of existing problems.

OPERATOR'S SAFETY

Special attention has been paid to the “Safety system” that is controlled by a “Supervisor” checking the condition of all parts and acting in case of inconveniences of the electronic system. When the electronic system is enabled, the supervisor checks the different clusters making up the logic unit and in case of anomalies blocks all operations, avoiding dangerous conditions for the operator. Possible short circuits existing or caused at the ends of running contactor coils are neutralised by the electronic circuit controlling contactors that transfers the information to the supervisor in order to block all controls until the anomaly



condition is removed. The actual efficiency of the safety supervisor can be checked by the operator without any danger (see EEC standard 86-663 par. 9.7.3.5.5). Another very important function for the operator's safety is the emergency dynamic braking. This function has been included in the "System-Mos" line and can be used to carry out a strong braking when the dead man protection (generally present on transpallets) is enabled, or as alternative to the anti-rollback function, to avoid back up movements of the lift truck during start on the climb. The power module type "System-Mos" offers many other advantages, such as: soft acceleration (that can be adjusted from the outside), possibility to use a unidirectional potentiometer (with no need to carry out adjustment) or a bidirectional potentiometer with electric centring of rest position, "EPS" system (by Elektrosistem) enabling a constant current braking with a very efficient operation dynamic of the vehicle, etc...

The "System-Mos" line is available from 220A to 550A, with battery voltages that ranging from 12V to 80V make these choppers a product connecting the small power line (ETC...M) with the thyristor high power line (PWF and PULSAR). The System-Mos choppers are therefore suitable for medium power vehicles such as transpallets, small lift trucks, floor washers and sweepers and can control series excited DC motors with 2, 3 and 4 terminals.

MAIN FEATURES

- # Soft starting by means of acceleration slope that can be adjusted from the outside.
- # Limiter of max. current applied to the motor that can be adjusted from the outside.
- # Automatic limiter of short circuit current.
- # Thermal limiter with proportional action.
- # Braking system type "EPS".
- # Emergency electric braking.
- # Internal supply type SWITCHED-MODE.
- # Electric centring of bidirectional potentiometers.
- # Possibility to use a unidirectional potentiometer with no need of adjustment.
- # Display of different operation conditions by means of green and red LEDs.
- # Total protection against battery polarity reversal.
- # Safety supervisor circuit with automatic reset, including:
 - a) Check of logic undersupply
 - b) Check of short circuit on contactors driver
 - c) Check of mechanical failure of accelerator pedal
 - d) Check of power part malfunctioning
 - e) Check of short circuit or interruption of the speed adjusting potentiometer.

POWER MODULE TECHNICAL SPECIFICATIONS

POWER MODULE = CHOPPER complete with CONTACTORS for Forward and Backward Running for 3 and 4 Terminal Motors

Voltage	12-36 VDC	Thermal limiter action	80 °C
Allowed variation	67÷125 %	Max. voltage supplied at 12VB	88 %
Operation frequency	0÷350 Hz	Max. voltage supplied at 24 and 36VB	94 %
Ambient temperature	from -20 to +40 °C	Max. voltage supplied at 48VB	97 %
Relative humidity at 25 °C	90 %	Insulation of mechanical parts	2VB + 1000 V

Models	SYSTEM-MOS 22	SYSTEM-MOS 250	SYSTEM-MOS 35
Voltage	12-24-36V	48V	12-24-36V
Current supplied for 1'	220A	250A	350A
Current supplied for 1 hour	120A	160A	210A
Short circuit current	240A	275A	385A



MECHANICAL CLEARANCE

Fig. -1 Dimensions SYSTEM-MOS 22

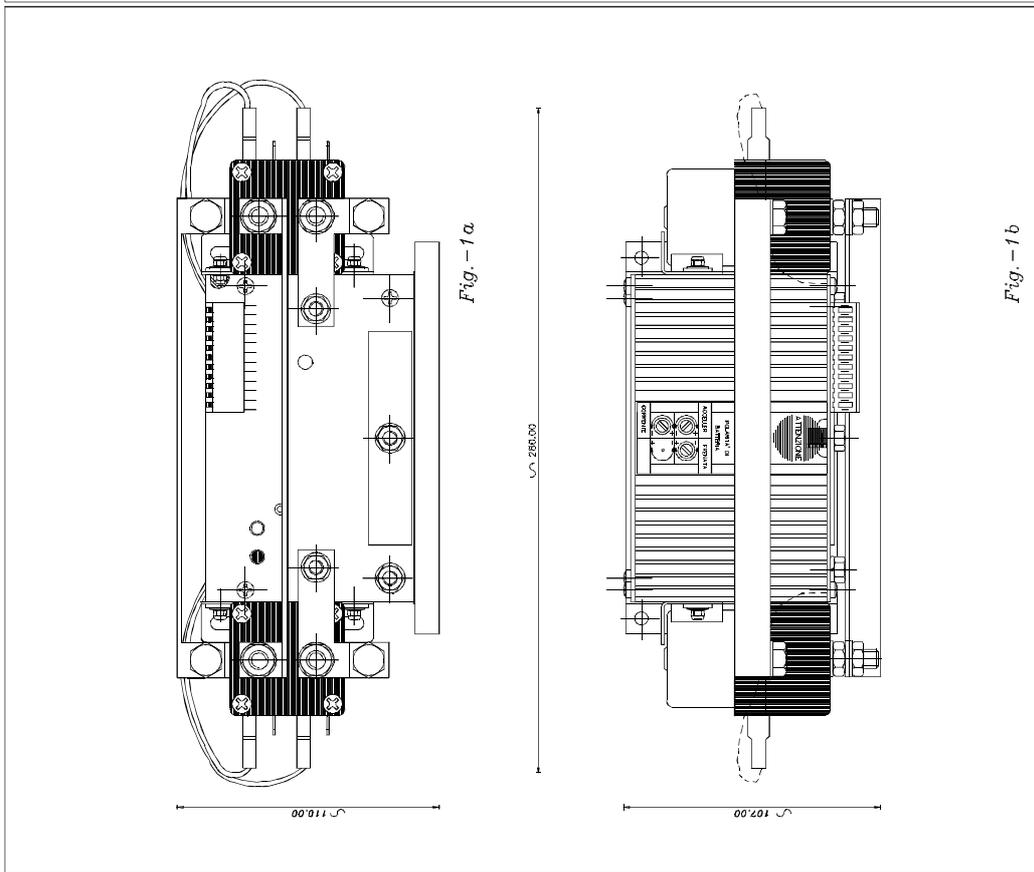
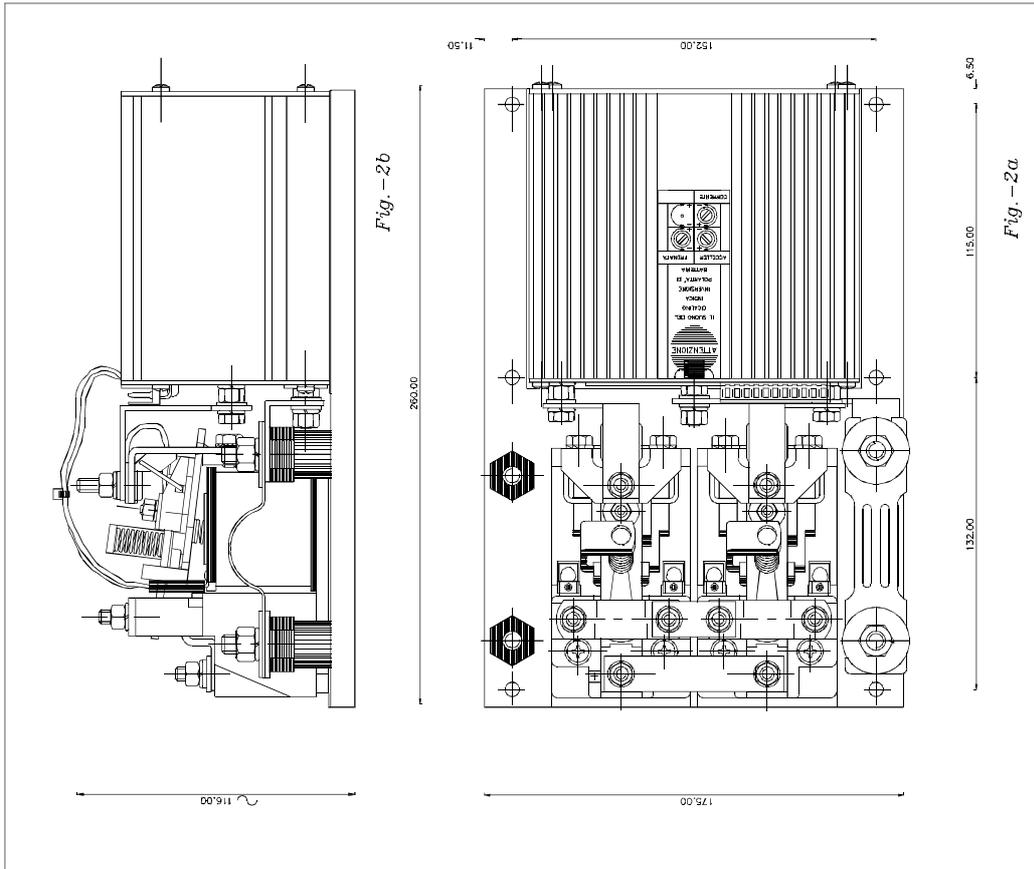
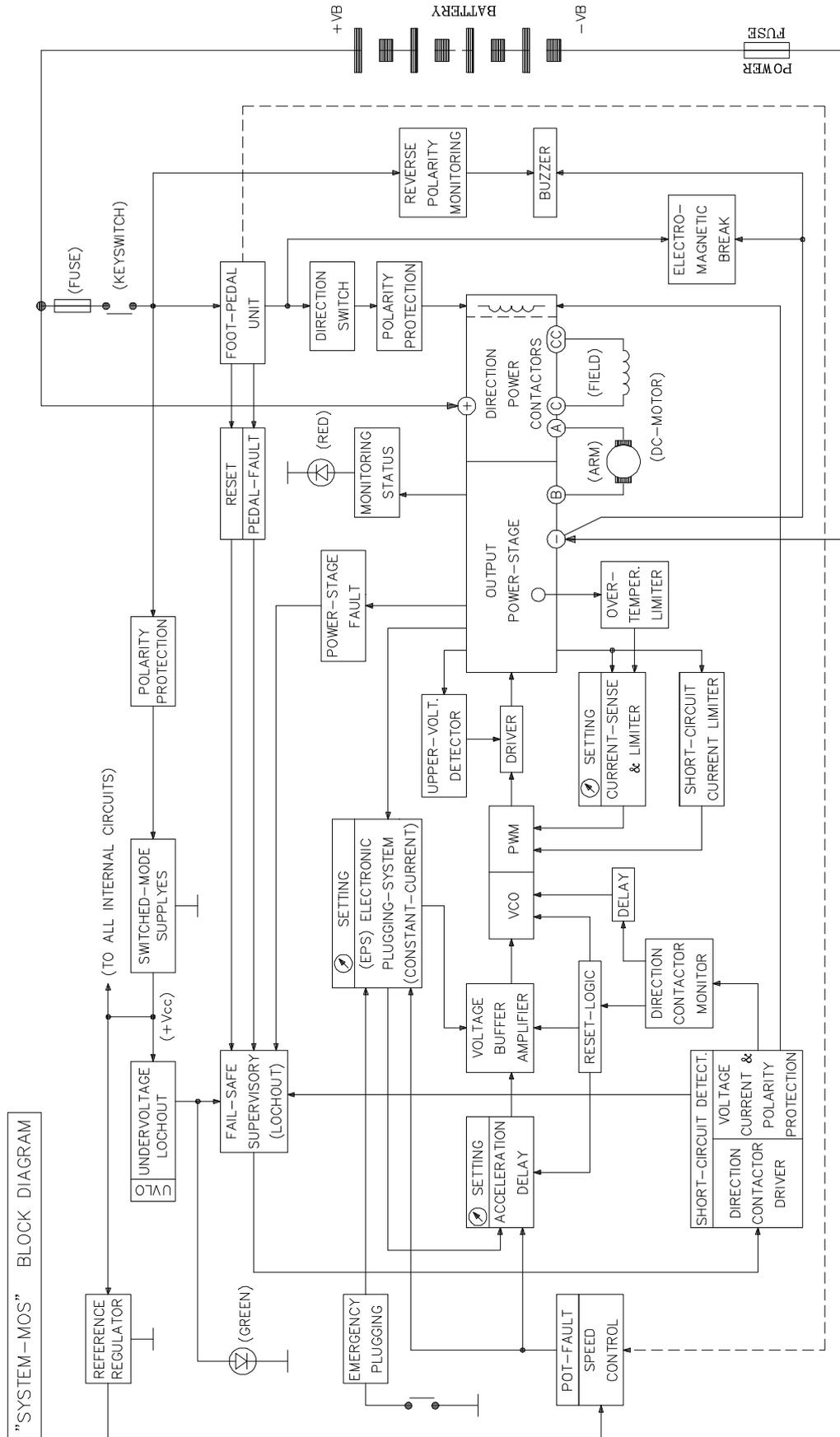


Fig. -2 Dimensions SYSTEM-MOS 250 and SYSTEM-MOS 35







CHOPPER TECHNICAL SPECIFICATIONS

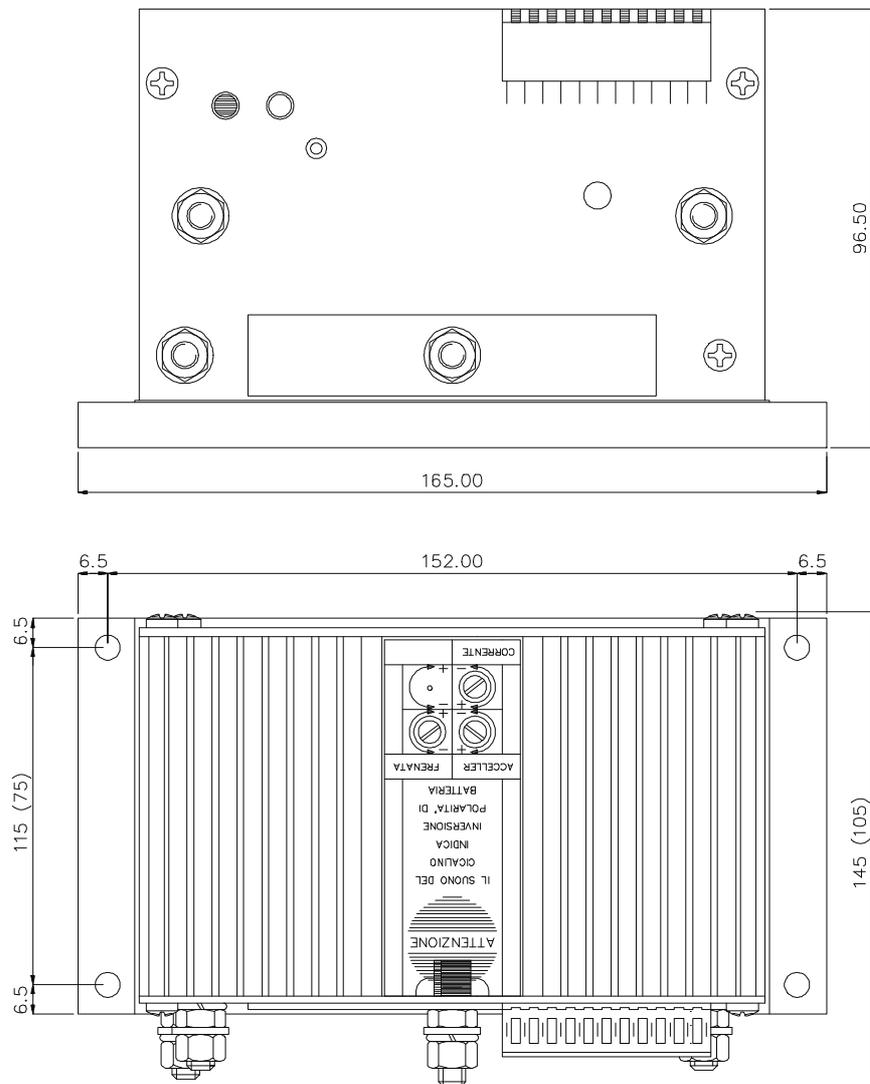
Voltage	24-80 VDC	Thermal limiter action	80 °C
Allowed variation	67÷125 %	Max. voltage supplied at 12VB	88 %
Operation frequency	0÷350 Hz	Max. voltage supplied at 24 and 36VB	94 %
Ambient temperature	from -20 to +40 °C	Max. voltage supplied over 48VB	> 97 %
Relative humidity at 25 °C	90 %	Insulation of mechanical parts	2VB + 1000 V

Models	MOS 22	MOS 30 with Filter*	MOS 35
Voltage	24-36V	24-80V	24-36V
Current supplied for 1'	220A	300A	350A
Current supplied for 1 hour	120A	170A	210A
Short circuit current	240A	320A	380A

* Available even without filter to be applied on SCR control units.

N.B. 12V model only on request.

MECHANICAL CLEARANCES



N.B. The data in brackets refer to the control unit type MOS 22.

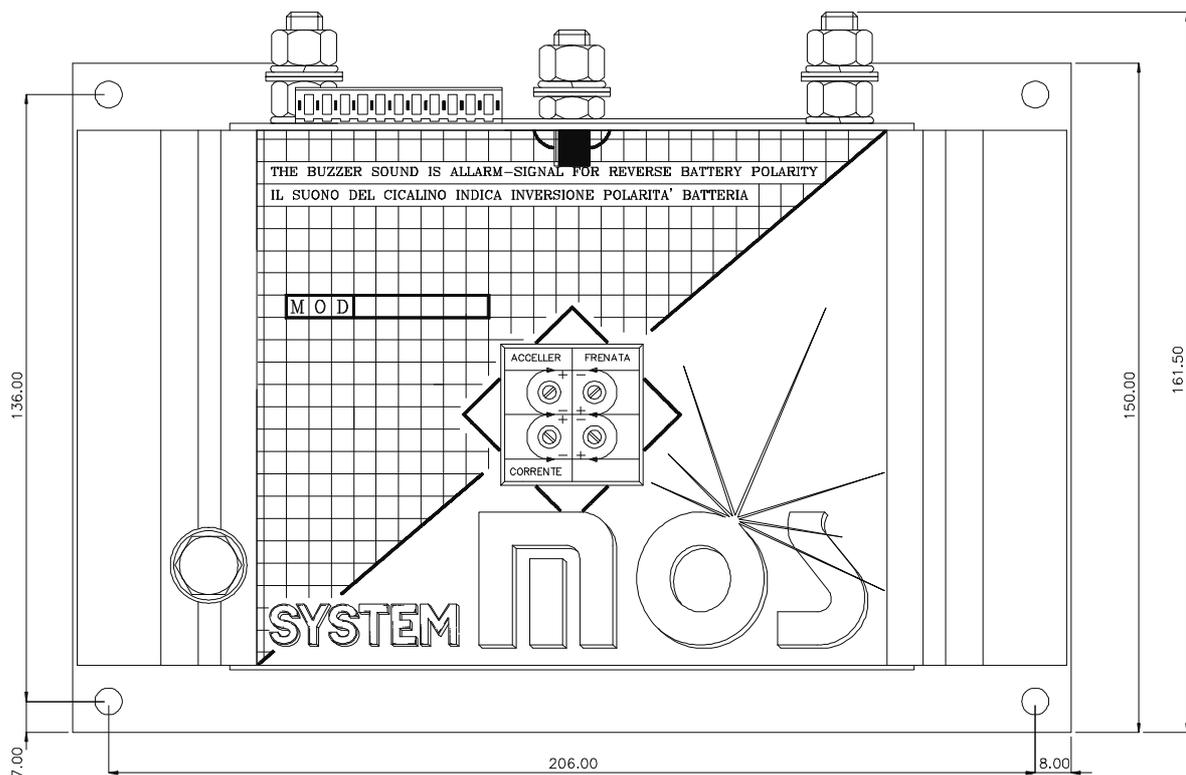
~~NEWS~~

CHOPPER TECHNICAL SPECIFICATIONS

Models	MOS-355	MOS-55
Voltage	24-80V	24-80V
Current supplied for 1'	350 A	550 A
Current supplied for 1 hour	210 A	300 A
Short circuit current	385 A	600 A

N.B. 12V model only on request.

MECHANICAL CLEARANCES





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ACI3



HIGH FREQUENCY CONTROLLER FOR AC INDUCTION MOTORS

ACI3 is a bidirectional high frequency controller designed to control AC asynchronous three-phase motors (induction motors). The main advantage coming from the use of a similar equipment is the absence of running contactors resulting in a very simple maintenance. The controller features a three-phase inverter inverting the battery DC voltage into the AC voltage required by the motor.

The system must be equipped with a main contactor to guarantee insulation of the controller from the battery in emergency situations to meet the safety requirements in force.

The controller also features regenerative braking acting when the running control is released and during reversing. Operation parameters can be modified by programmer or PC and serial interface.

FEATURES

- Controller for AC induction motors
- MOSFET technology and high frequency operation to control the three phases
- DSP 16 bit microcontroller with self test of control circuitry
- Handheld programmer to modify operation parameters
- PC interface to set parameters
- Regenerative braking acting when the running control is released and during reversing
- Control by 5K 3-wire potentiometer
- Control by central 0 potentiometer
- Protection against potentiometer failure
- Protection against MOSFETs short circuit
- Over-temperature protection
- Protection for potentiometer not in neutral position at start-up
- Over-voltage and under-voltage protection
- 5 outputs to control main contactor, timed power steering, electromagnetic brake or other functions.
 - 2 24V contactors with short circuit and coil protection
 - 3 24V contactors with coil protection
- 6 inputs for auxiliary functions
- On-board fault code status LED
- Advanced communication protocol for integration into other control systems and displays
- Operation with or without encoder

TECHNICAL SPECIFICATIONS

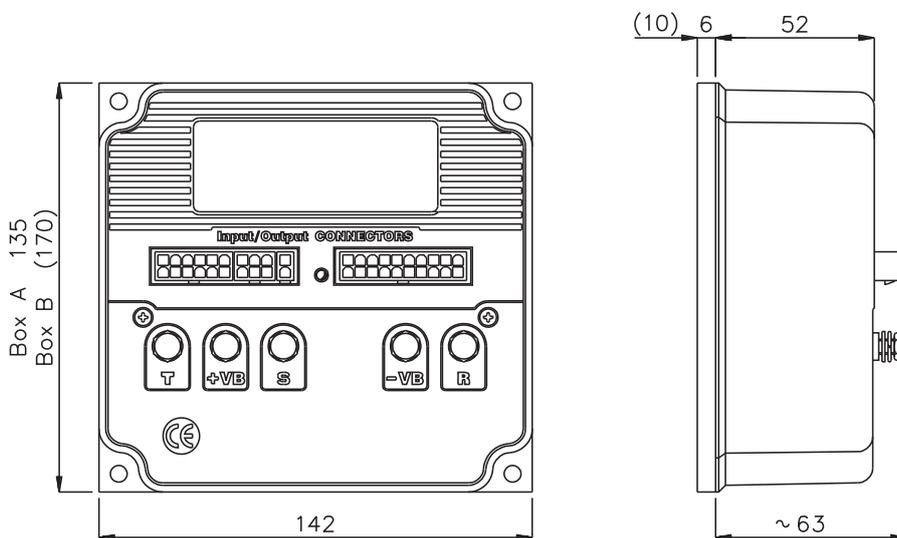
- Rated voltage from 24 to 96V
- Continuous output power 850 W for motors up to 16 Kw
- Operating temperature -20°C/+40°C
- Thermal protection from 70 to 80°C



MODELS AND DIMENSIONS

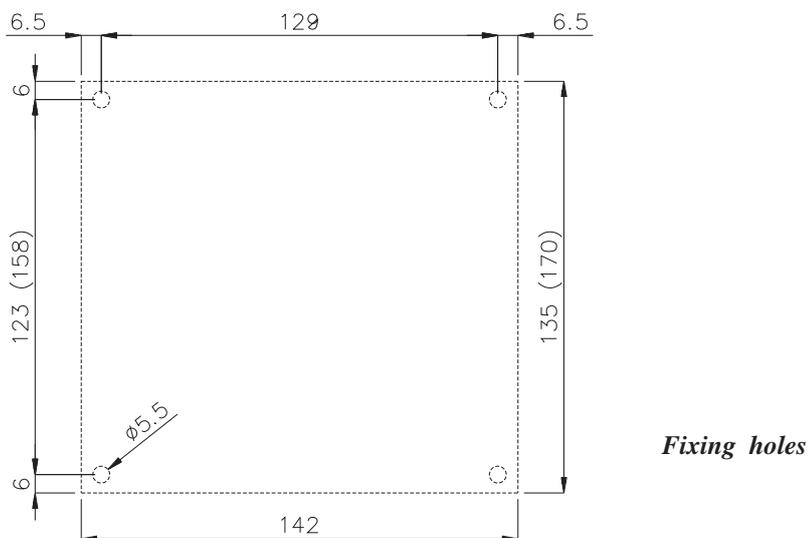
MODEL	PHASE CURRENT	MOTOR POWER	VOLTAGE	BOX
ACI3 - 10	100A RMS	24V Motor up to 1100W 48V Motor up to 2200W	24-48V	A
ACI3 - 30	300A RMS	24V Motor up to 2400W	24V	B
ACI3 - 30	250A RMS	36V Motor up to 3000W 48V Motor up to 4000W	36-48V	B
ACI3 - 50	500A RMS	96V Motor up to 15000W	96V	C
ACI3 - 50	600A RMS	80V Motor up to 16000W	24-80V	C

The control unit can be supplied complete with aluminium base or finned heatsink.



Weight 900g for A Box
Weight 1500g for B Box

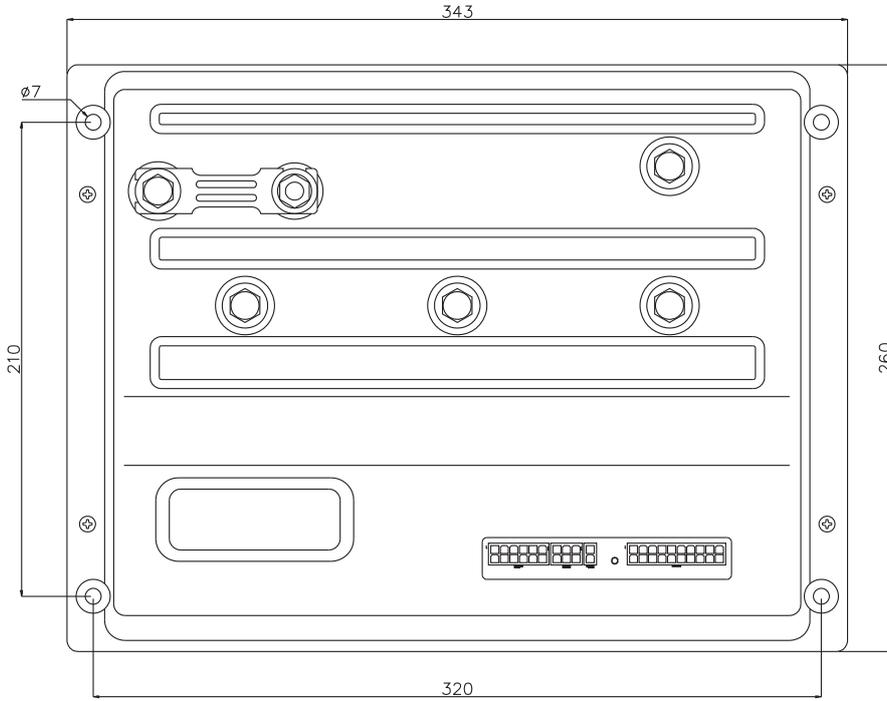
ACI3-10
ACI3-30



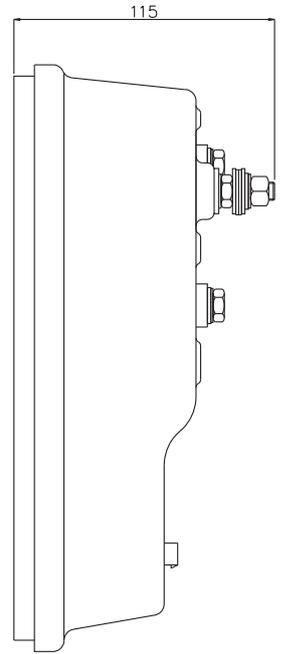
N.B. Dimensions in brackets are referred to the B Box (ACI3-30)
Specifications subject to change without notice

~~NEWS~~

MODELS AND DIMENSIONS



Weight 7500g for C Box



ACI3-50



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HANDLE UNIT

The handle unit is generally used with battery supplied vehicles with operator on the ground.

It has a simple, functional and high hardness mechanical structure with polyamid shock-resistant chassis.

The handle unit is equipped with forward and reverse direction functions controlled by two butterfly switches, horn push button and key switch that in off position, disable all electric functions and is supplied with a two meter sheath insulated wiring harness. A model with push buttons for electric control of lift and lower functions is available.

The handle unit is equipped with the emergency reverse function (deadman) for the operator on the ground, causing reversal with forward speed equal to reverse speed.

A further safety device (SUM card) is available in two versions:

1) with reversal

it causes reversal and blocks the vehicle when the deadman microswitch opens. Reset is possible only bringing butterfly switches in off position. When combined with this card the handle unit is generally supplied with electromagnetic brake control.

2) with stop

it stops the vehicle.

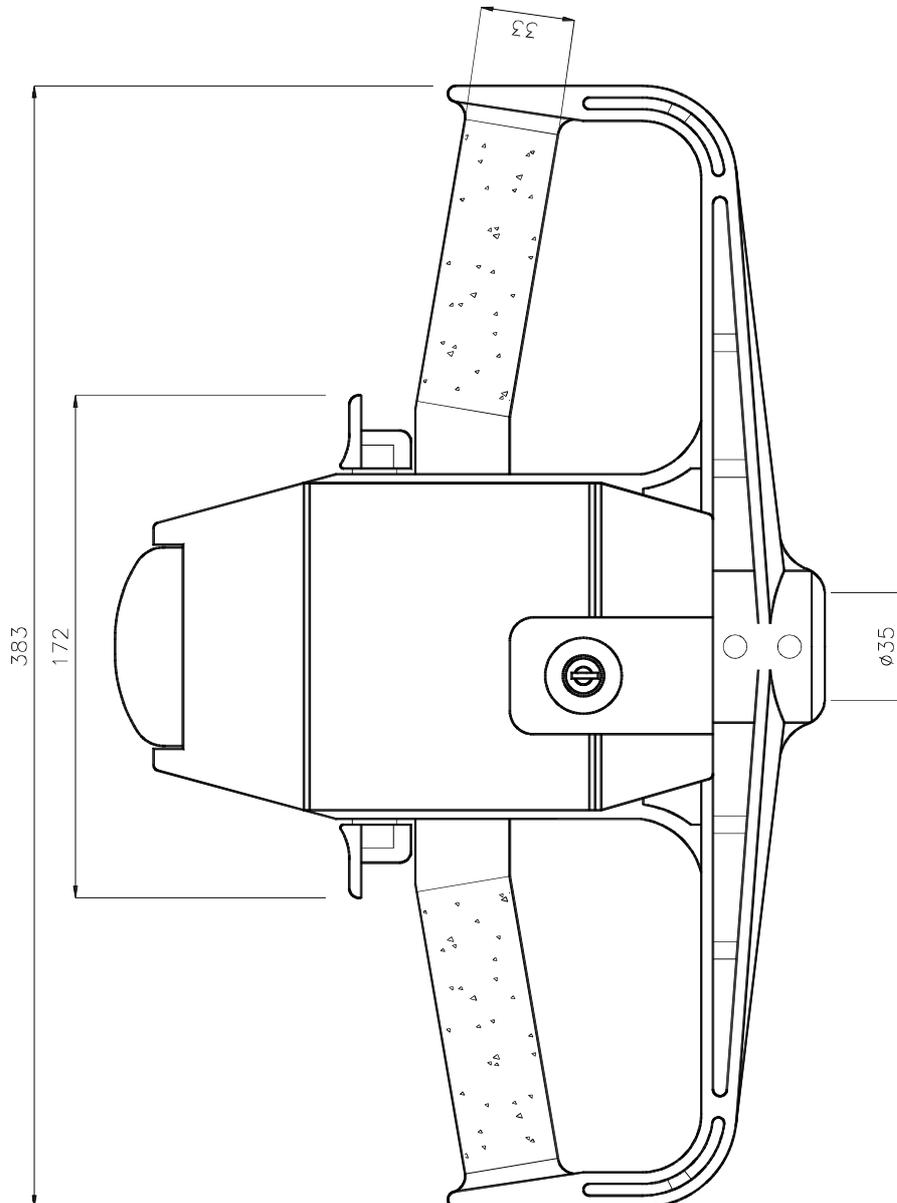
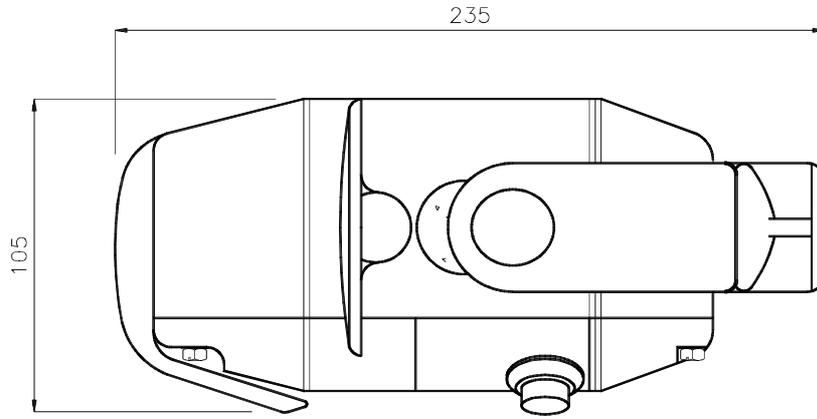
On request all versions can be equipped with electromagnetic brake function.

FEATURES

Material	Fiberglass reinforced polyamid 6
Operation temperature	From -40 °C to +120 °C
Inflammability UL	HB
Impact strenght DIN 53453	Kj/m ² 60 at +23 °C Kj/m ² 52 at -40 °C
Standard colours	Black, with green butterfly switches and red emergency button

~~NEWS~~

MECHANICAL CLEARANCE





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PRS COMPACT FOOT PEDAL

PRS foot pedals have been designed to solve those problems related to the small dimensions of the space where the foot pedal can be located.

Assembling is extremely simple thanks to electric connection through connector. The foot pedal is supplied complete with a 10 cm wiring with connector already fitted.

The external structure of galvanized iron guarantees high efficiency and long life, even when used in environments with a high degree of humidity.

The precision assembly carried out on ground shaft guarantees a very low mechanical wear and the absence of clearances.

The running consent is given by a cam controlled micro switch and speed regulation is carried out by a 5Kohm potentiometer. According to the controller to be used with, the foot pedal is also available without running micro switch.

The foot pedal can be supplied with right or left side pedal and must be used with a running direction selector fitted on the panel or on the steering wheel.

PRS production range

PRS 1M SX

Compact foot pedal with running micro switch and left side pedal.

PRS 1M DX

Compact foot pedal with running micro switch and right side pedal.

PRS 1 SX

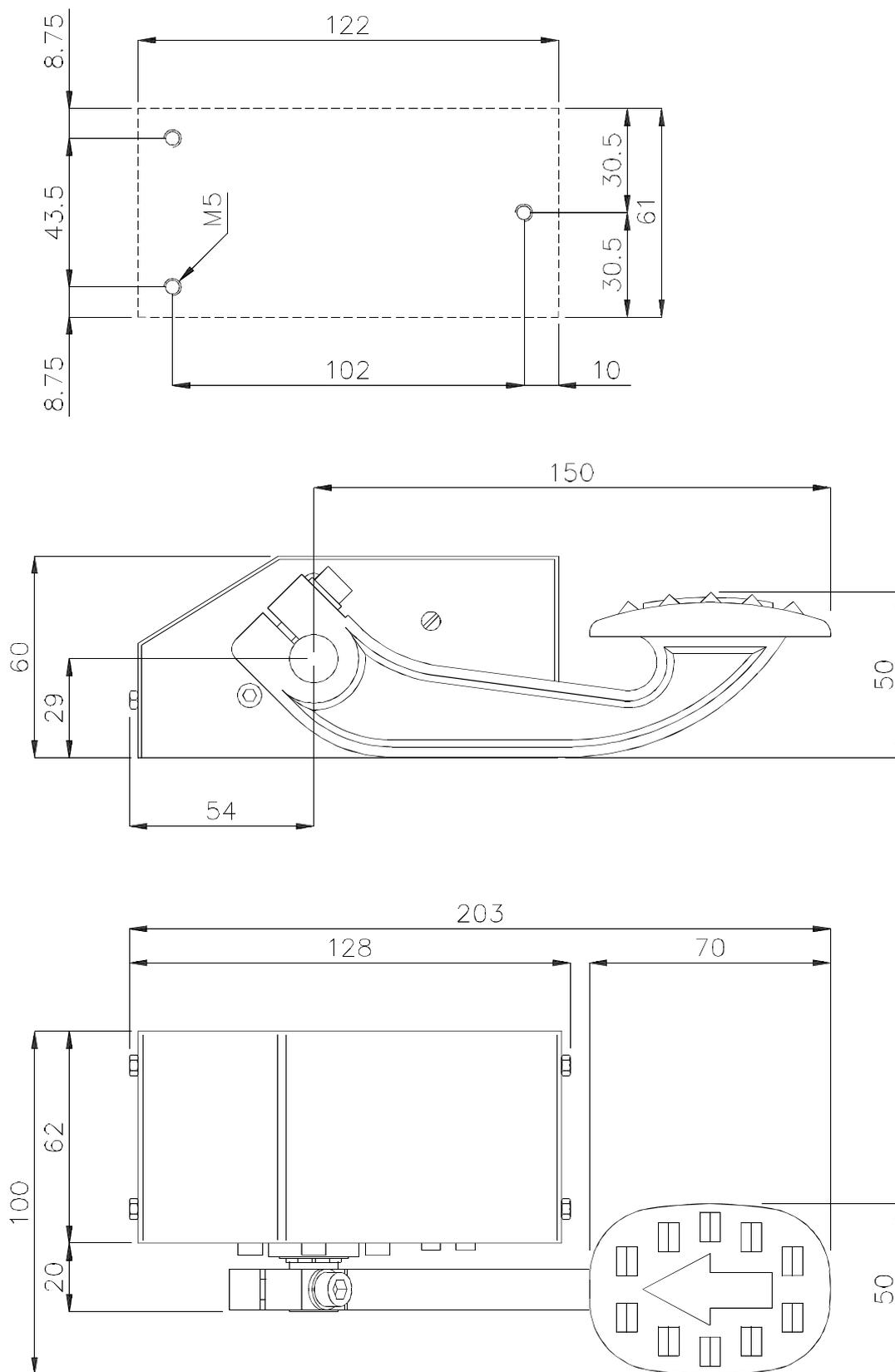
Compact foot pedal with left side pedal and without running micro switch.

PRS 1 DX

Compact foot pedal with right side pedal and without running micro switch.



DIMENSIONS AND FIXING HOLES



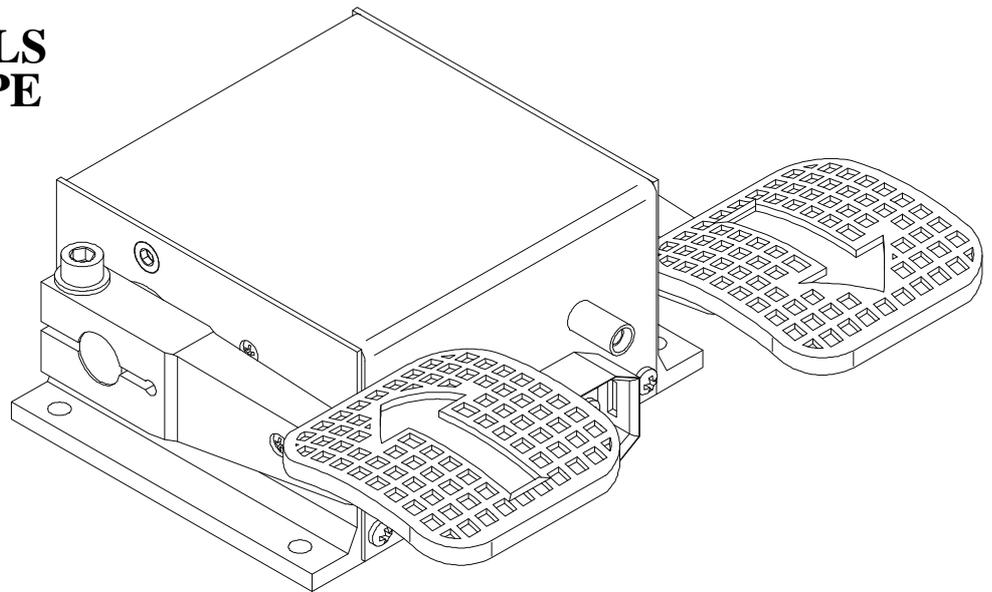
For right side pedal consider pedal dimensions on the opposite side of the box.
N.B. All dimensions are in mm.



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PR/1B and PE/2 CONTROL FOOT PEDALS MOD. PR / PE



PR/1B and PE/2 foot pedals comply with all requirements concerning use in lift trucks and electric vehicles thanks to their compact size, simple assembling and electric connection through connector.

Externally made of aluminium profile foot pedals guarantee high efficiency and long life, even when used in environments with a high degree of humidity and subjected to continuous climate changes.

The precision assembly carried out on ground shaft guarantees the lowest mechanical wear and the absence of clearances.

Running and by-pass consents through cam controlled microswitches and speed regulation through 5 Kohm potentiometer make foot pedals a reliable and strong product.

Foot pedals can be supplied with a bored lever to be used as actuators of systems already present on the machine.

PE/2 foot pedal is equipped with two pedals while PR/1B has one left or right side pedal according to the application requirements and must be applied together with a running direction selector fitted on the panel or on the steering wheel.

PR/1B production range

PR/1B - Running and by-pass consents.

PR/1BR - As in PR/1B, with braking at running pedal release. Special model to be use with PULSAR R controller.

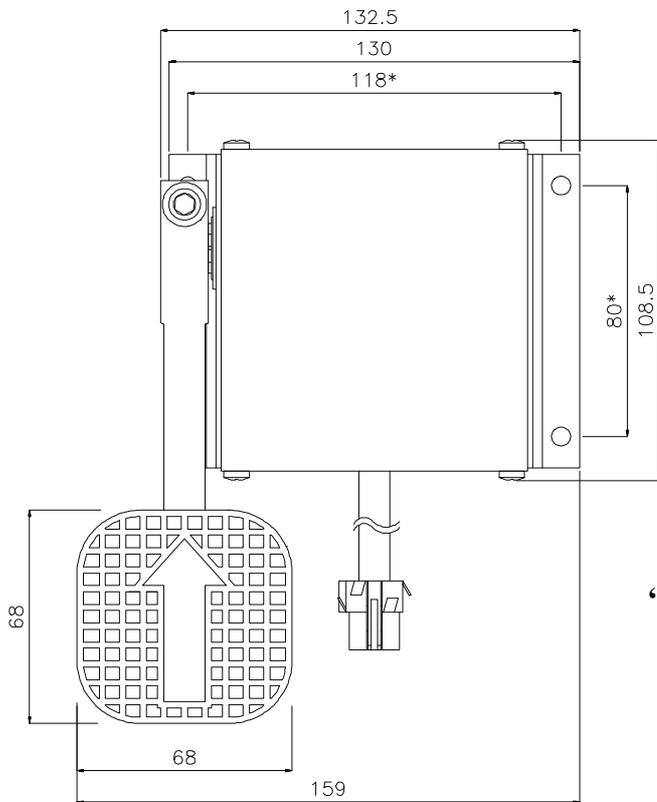
PE/2 production range

PE/2 - Forward, reverse and second speed consents.

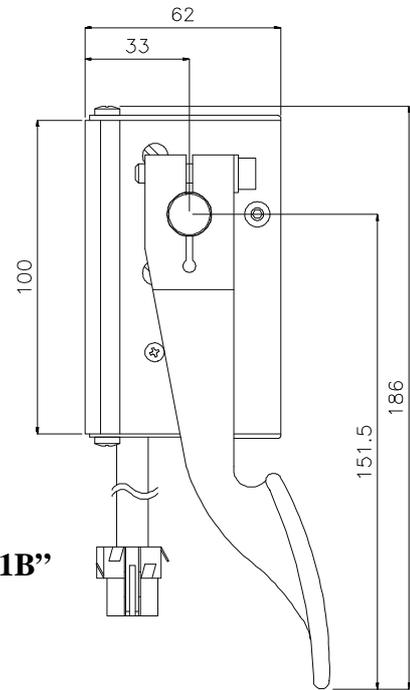
PE/2R - As in PE/2, with braking at running pedal release. Special model to be use with PULSAR R controller.



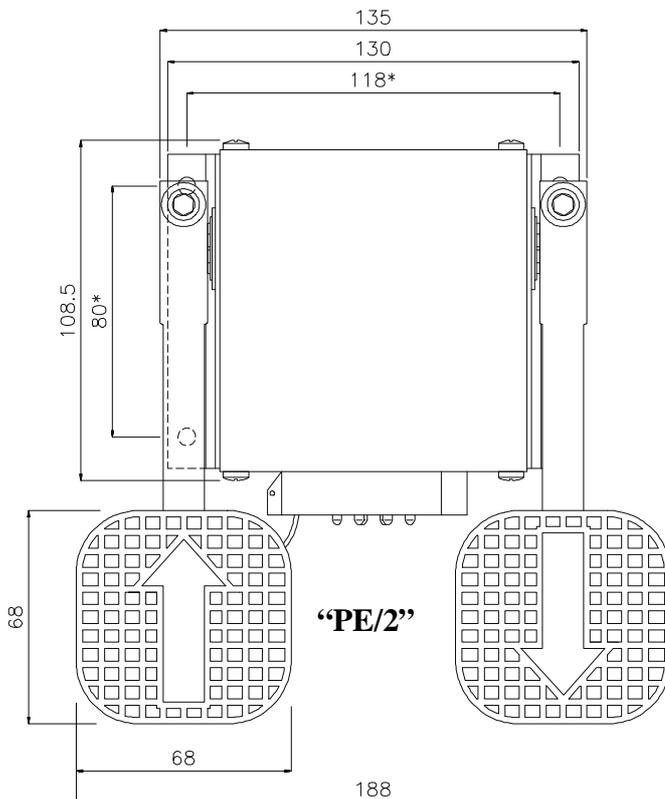
PEDAL DIMENSIONS



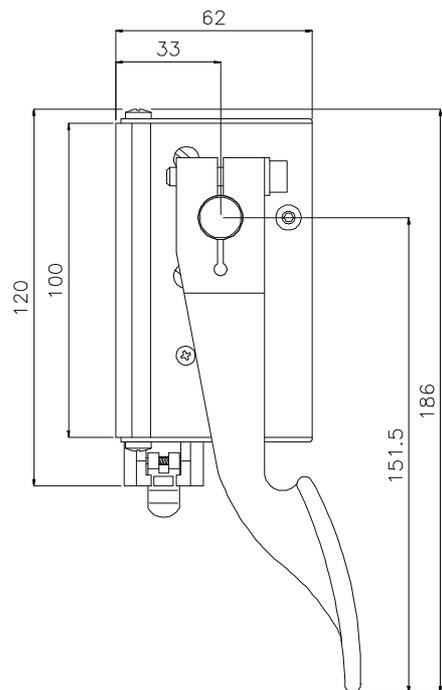
“PR/1B”



* n°4 holes Ø5,5 for fastening
N.B. All dimensions are in mm.



“PE/2”



* n°4 holes Ø5,5 for fastening
N.B. All dimensions are in mm.



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ACCELERATOR HANDLE

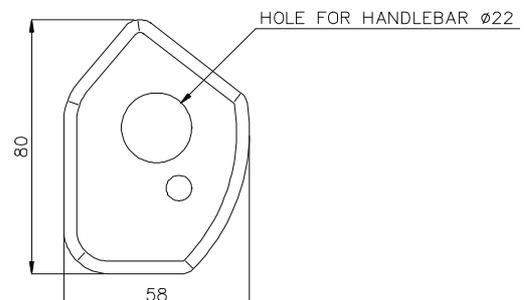
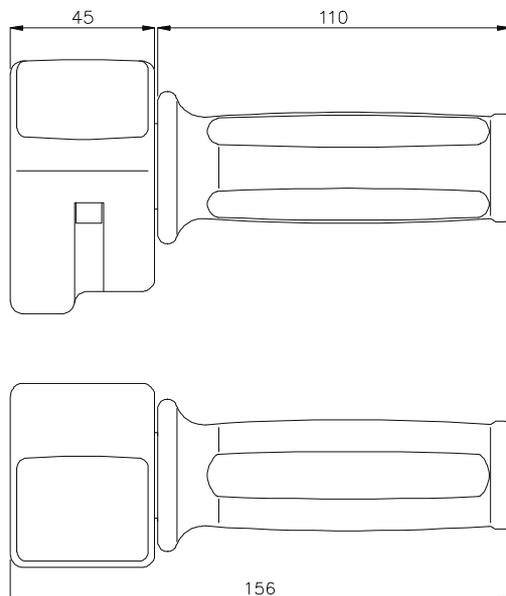
The accelerator handle is a speed control device generally used on vehicles with handlebar.

The accelerator handle is always equipped with potentiometer, sheathed wiring (standard length is 2 mt) and left handle. According to the customer's needs and to the application some devices can be added, like:

- ON-OFF switch usually used as key switch,
- LED to signal the vehicle switching on,
- microswitch for running control selection necessary for some control units,
- 1-0-2 switch used as running direction selector for bidirectional applications or min. and max. speed selector for one direction applications.

On request customized accelerator handles can be delivered.

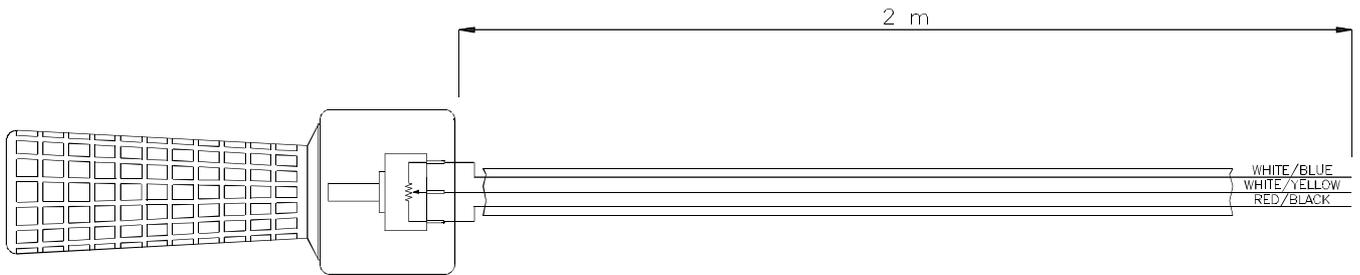
DIMENSIONS in mm.



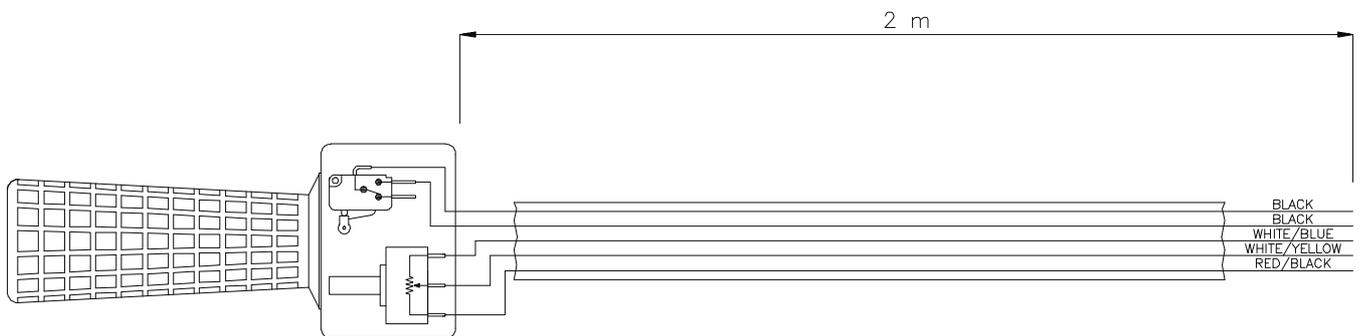
~~NEWS~~

WIRING DIAGRAMS

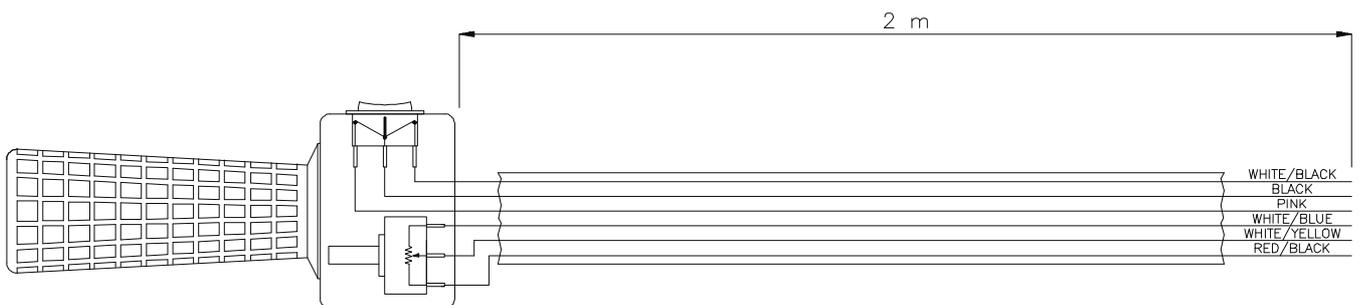
With potentiometer



With potentiometer and microswitch



With potentiometer and direction selector





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SPC500 and SPC500m

DC/DC ISOLATED CONVERTERS



SPC500 has been designed to provide power to auxiliary electrical circuit on electric vehicles, where it is necessary to separate main and auxiliary unit.

SPC500m is specific for use with a 12 or 24 VDC buffer lead-acid battery to be connected in parallel to the output for high peak currents, particularly used in hybrid vehicles to start thermal motor.

The microprocessor controls and optimises charging and avoids overloads thus reducing maintenance operations.

SPECIFICATIONS

- Max. continuous power 500W
- Short circuit protection and input reverse polarity protection
- SPC500m special for buffer batteries
- Operation frequency 70KHz
- Output voltage is factory selectable
- Tolleranza della tensione in uscita $\pm 2\%$
- $\pm 2\%$ output voltage tolerance
- Current limit 40A at 13.2V and 20A at 26.4V
- Output voltage ripple 100mV pp at 20A 26.4V
- Input voltage from 80% to 125% of nominal
- Input and output galvanically isolated according to EEC 86/663 and UL 583
- Di-electric isolation 1250 volts at 50Hz sinusoidal for 1 minute
- Ambient operating temperature from -30°C to $+45^{\circ}\text{C}$
- Exceeds EMC specifications: EN50081-2 for immunity and EN50082-2 for emission
- Efficiency 85-90%
- Weight 1,9 Kg

* SPC500m model has 14.4V output voltage during battery charging (for 12V model) and 28.8V (for 24V model)

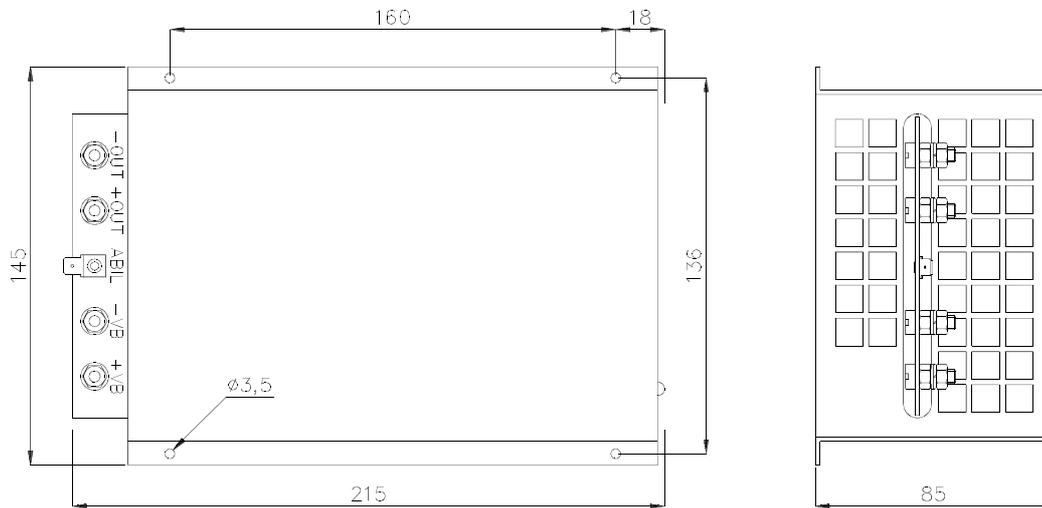


MODELS

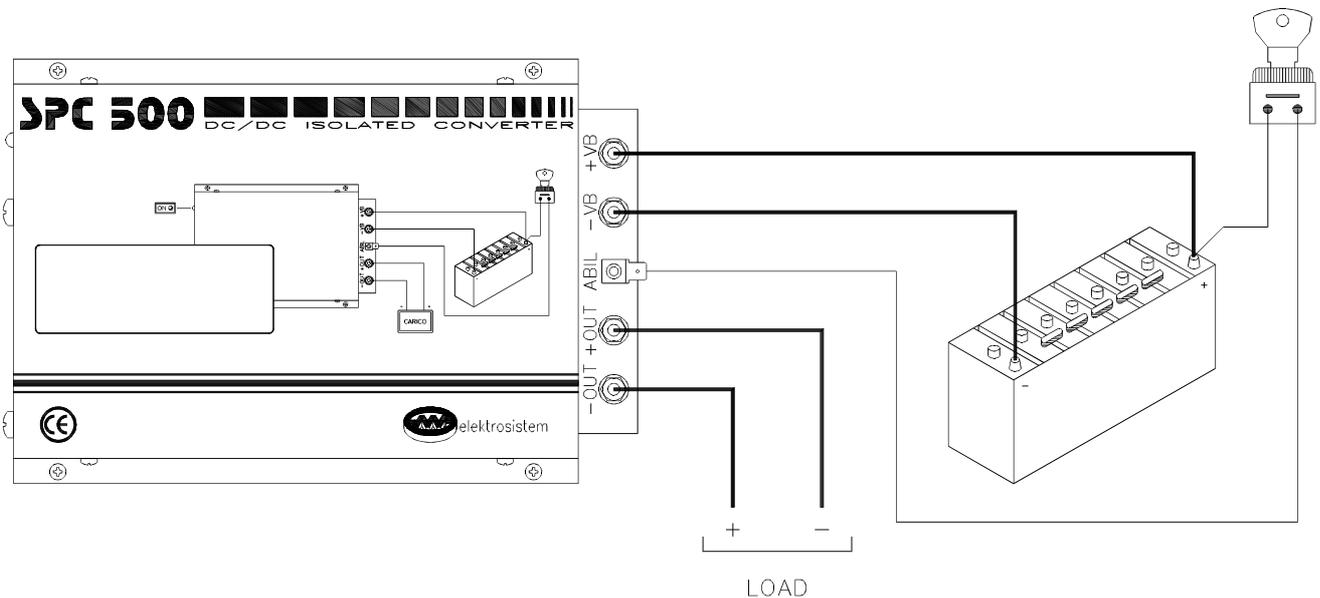
SPC-500			
REF.	Vout	Vin	Imax
15.001062	12V	48/60V	40A
15.001060	12V	72/120V	40A
15.001063	24V	48/60V	20A
15.001061	24V	72/120V	20A

SPC-500m			
REF.	Vout	Vin	Imax
15.001058	12V	48/60V	40A
15.001056	12V	72/120V	40A
15.001059	24V	48/60V	20A
15.001057	24V	72/120V	20A

DIMENSIONS



WIRING DIAGRAM





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DC-DC SWITCHING CONVERTERS

SMPS08F
SMPS15F
SMPS30FA



SMPS DC-DC switching converters have been specially designed by ELEKTROSISTEM to provide power to auxiliary electrical circuits on battery powered vehicles like windscreen wipers, driving lamps, fans, flash lights, servo-controls, etc...

Thanks to the compact size for an easy installation and to the switching technology they represent a valid and money-saving alternative to resistive and linear converters or to electric auxiliary equipment with battery tapping (which may damage batteries).

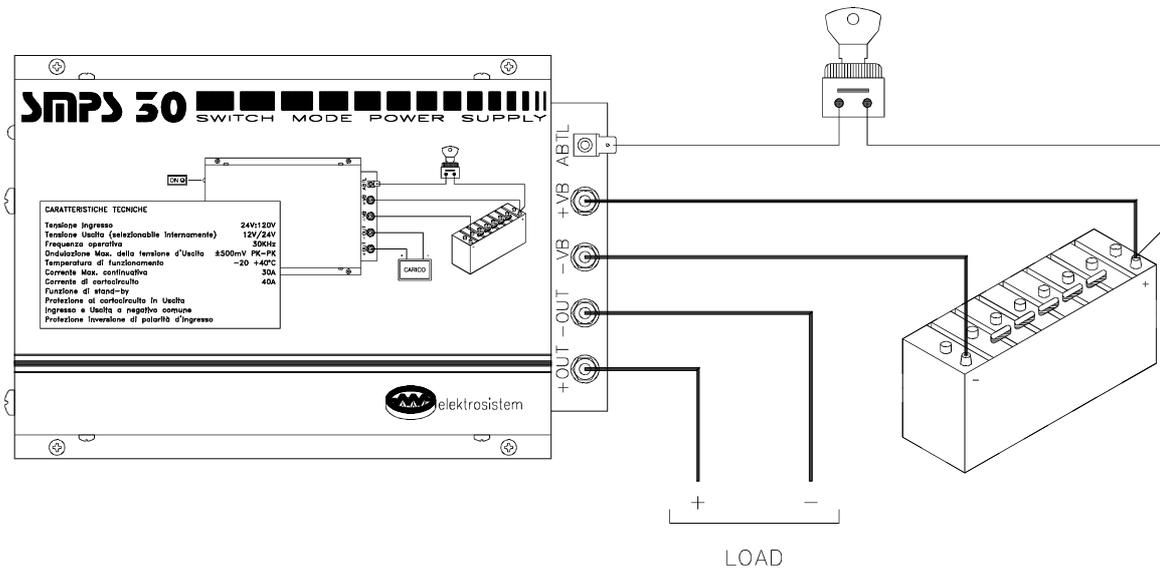
The advanced technology and the high efficiency make SMPS08F, SMPS15F and SMPS30FA converters a reliable, versatile and competitive product.

TECHNICAL SPECIFICATIONS

<i>MODELS</i>	SMPS08F	SMPS15F	SMPS30FA
Protection against output short circuit	✓	✓	✓
Stand-by function	✓	✓	✓
Input and output with common negative wire	✓	✓	✓
Operation temperature	from -20° to +40°C		
Efficiency	90%		
Weight	1Kg	2Kg	2.5Kg
<i>INPUT</i>			
Voltage	from 24V to 120V		
Operation frequency	60 KHz	30 KHz	30 KHz
Reverse polarity protection	Fuse + Diode		
<i>OUTPUT</i>			
Voltage	12V or 24V (by jumper inside the converter)		
Max. continuous current	8A	15A	30A
Short circuit current	10A	20A	40A

~~NEWS~~

WIRING DIAGRAM for SMPS08F, SMPS15F and SMPS30FA

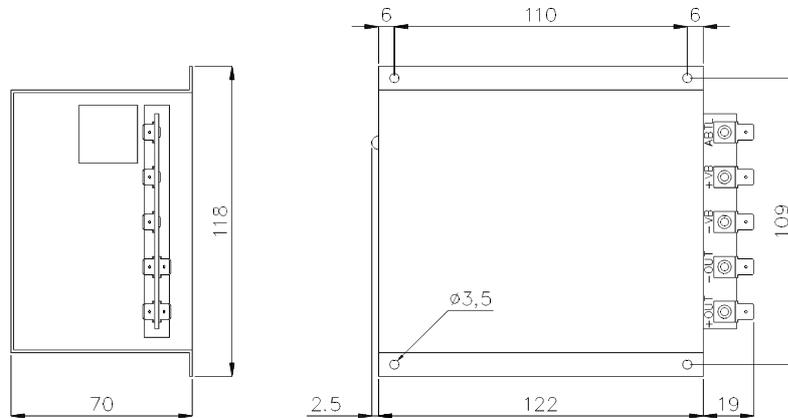


WARNINGS:

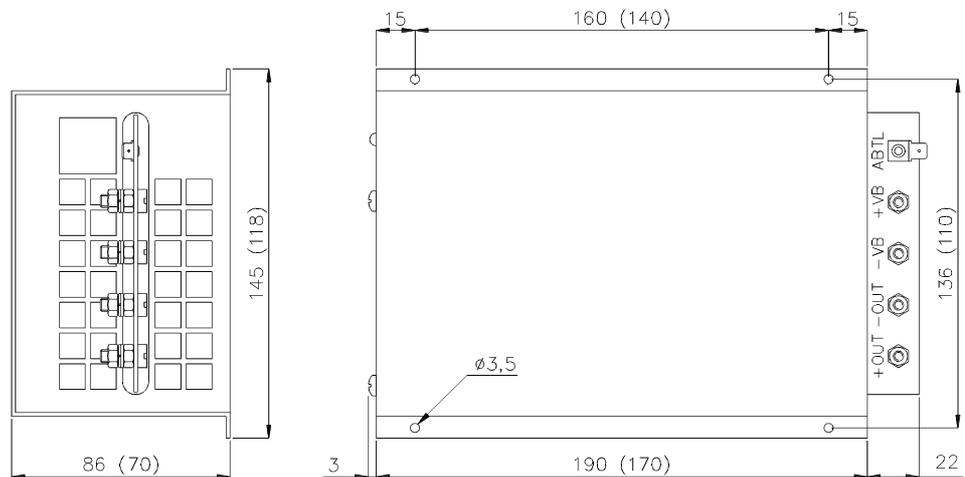
Assemble in a position that does not hinder forced ventilation for heat disposal; do not obstruct ventilation grids.

DIMENSIONS

SMPS08F



SMPS30FA (SMPS15F)





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SWITCHING POWER SUPPLY

MODEL SMPS-09A

The high frequency power supply type **SMPS 09A** has been designed according to the MOSFET technology. A high performance transformer has been installed in order to ensure a performance higher than 90%, yet granting the minimum power/size ratio.

Moreover a noiseless operation and an easy installation make this power supply extremely reliable and functional.

TECHNICAL SPECIFICATIONS

Protection against overloading
Running temperature: -25°C $+40^{\circ}\text{C}$
Running frequency: 60 KHz

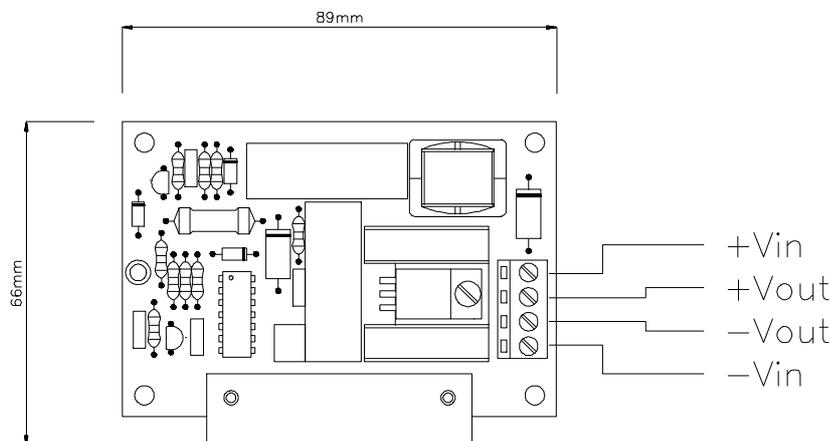
Input

Voltage rating: 12/24/36/48/60/72/80/96/120V
Operation frequency: 60 KHz
Protection against short circuits (10 seconds)
Protection against polarity reversal

Output

Stabilized voltage: 12 or 24V
Voltage stabilization max. 1%
(under the worst conditions)
Power: Continuous 70W/24V - 35W/12V
Limit current: 3A/12V - 3A / 24V
Max. current per minute: 4A
Electronic protection against short circuit

MECHANICAL DIMENSIONS AND CONNECTION POINTS



NOTICE :

- ☞ Common positive system.
- ☞ Do not connect negative wires together.
- ☞ Do not connect the equipment cases which are power supplied in output to input negative wire.
- ☞ Install the power supply converter in adequate position, to allow heat disposal.



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SPC 300

ALIMENTATORE DC/DC GALVANICAMENTE ISOLATO PROTEZIONE IP65



La serie SPC300 è particolarmente indicata per l'alimentazione dei carichi ausiliari di veicoli a trazione elettrica dove si rende necessario l'isolamento galvanico fra impianto principale e impianto ausiliario.

La serie SPC300 è nata per alimentare carichi diretti in uscita, oppure in abbinamento a batteria al piombo da 12V o 24V da collegare in parallelo all'uscita (molto utilizzato nei veicoli ibridi per l'avviamento del motore termico).

L'utilizzo del microprocessore permette la gestione della carica in modo ottimale evitando dannosi sovraccarichi che costringono a frequenti interventi di manutenzione.

CARATTERISTICHE TECNICHE

- Potenza massima continuativa 300W
- Protezione da cortocircuito in uscita e da inversione di polarità in ingresso
- Frequenza operativa 70KHz
- Carica in tampone della batteria ausiliaria (tensione di mantenimento standard 2,38 V/el)
- Possibilità di taratura personalizzata (dallo stabilimento) delle tensioni d'uscita
- Regolazione della tensione in uscita $\pm 2\%$
- Limitazione di corrente 25A @ 14,3V e 13A @ 28,6V
- Ripple della tensione in uscita 50mV pp @ 13A 28,6V
- Tensione di ingresso ammessa dal 80% al 125% della tensione nominale
- Ingresso e uscita galvanicamente isolati come da normative EEC 86/663 e UL 583
- Isolamento dielettrico 1250 volts a 50Hz sinusoidali per 1 minuto
- Temperatura ambiente di lavoro da -30°C a +45°C
- Conforme alle normative EMC EN50081-2 per l'immunità ai disturbi e EN50082-2 per le emissioni
- Rendimento 85-90%
- Peso 2,3 Kg

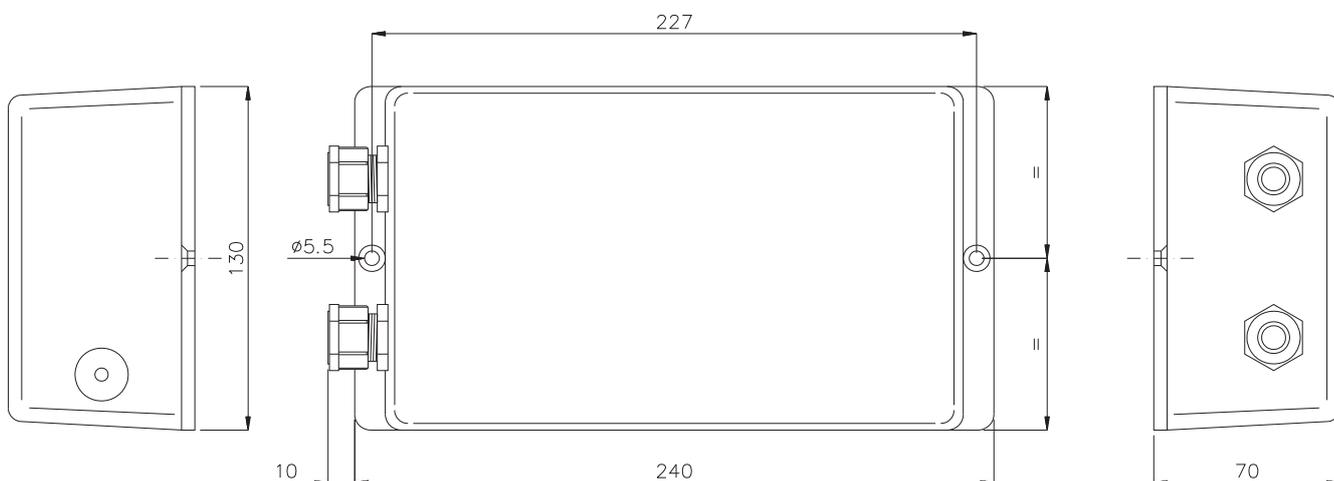
CARATTERISTICHE D'IMPIEGO	Dissipazione in aria		Dissipazione a contatto con superficie metallica	
	12 V	24 V	12 V	24 V
Tensione Nominale	12 V	24 V	12 V	24 V
Corrente Continuativa	18 A	10 A	22 A	11 A
Corrente Spunto 5 min.	25 A	13 A	25 A	13 A
Tensione Uscita	14,3 V	28,6 V	14,3 V	28,6 V

~~NEWS~~

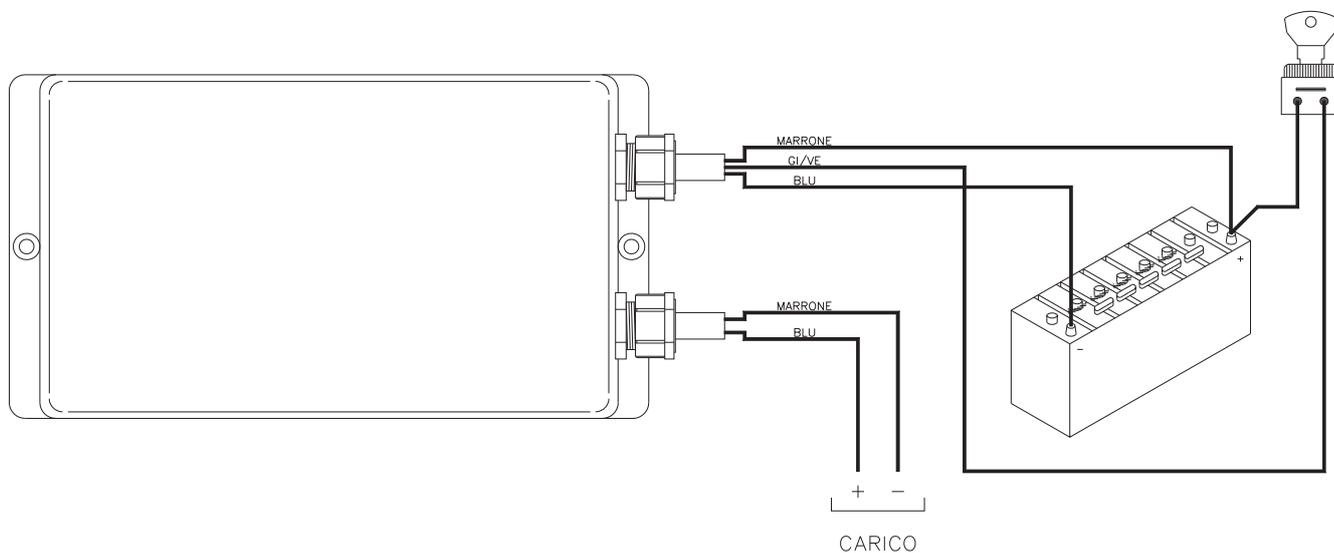
MODELLI

SPC-300			
CODICE	Vout	Vin	Imax
15.001201	12V	48/60V	25A
15.001202	12V	72/120V	25A
15.001203	24V	48/60V	13A
15.001204	24V	72/120V	13A

INGOMBRI MECCANICI



SCHEMA DI COLLEGAMENTO





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VEHICLE CONTROL SYSTEM

IVS



Simply intelligent

Elektrosistem IVS vehicle control system is a universal product designed to control sophisticated applications including many devices. It can be used in all applications: for thermal, electric and hybrid vehicles.

A user-friendly configuration software makes the product completely customizable to adapt to all suggested solutions. A reliable trouble shooting system based on LED technology makes all service operations easy and rapid.

Flexibility

Many inputs and outputs guarantee the interfacing with many different devices that can be connected to the vehicle control card:

12 digital inputs	Each input can be singularly programmed as high or low, max voltage to be applied is the supply voltage; in addition 4 digital inputs can be configured to acquire frequency signals (such as pulse pick-up).
6 analogue inputs	Extended configuration for 2 inputs, to acquire analogue signals such as 0-5VDC, 0-12VDC, +10/-10VDC.
2 inputs for encoder	The card supplies voltage to the encoder: a supply voltage ranging from +5VDC to +12VDC can be programmed and can be different from battery voltage. The encoder supply voltage and current are controlled by the microprocessor program.
1 RS 485 interface	It is used to connect the card to an industrial bus (such as a MODBUS)
1 RS 232 TL interface	It is used to configure some program parameters and update the firmware.
4 digital outputs	4 push-pull outputs, 1 open collector output. All outputs are current (sink) and PWM controlled with adjustable operating frequency. 4 push-pull outputs have a supply pin separated from that of the logic, so that all voltage different from battery voltage can be controlled. The open collector output can be used to control a main relay where the contact can be used for instance to cut off the card power supply (max 2A for each output).

CAN technology

The increased complexity of 'vehicle systems' traditionally designed forced to the development of technology platforms featuring high standards in safety, reliability, intelligence, and rapidity.

CAN BUS technology guarantees many advantages, including:

- less wiring,
- safety, reliability, and rapidity in data transmission,
- 'active' control of the vehicle system.

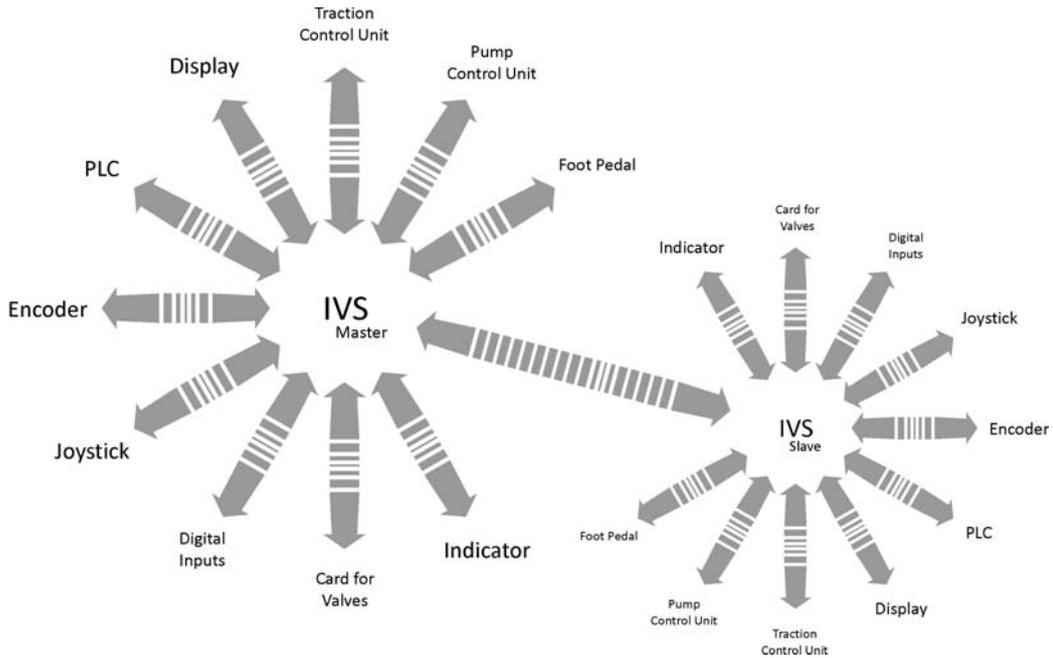
The control system handles two independent communication lines, one photo-coupled; moreover all main communication protocols based on CAN BUS technology can be used including the CAN OPEN system.



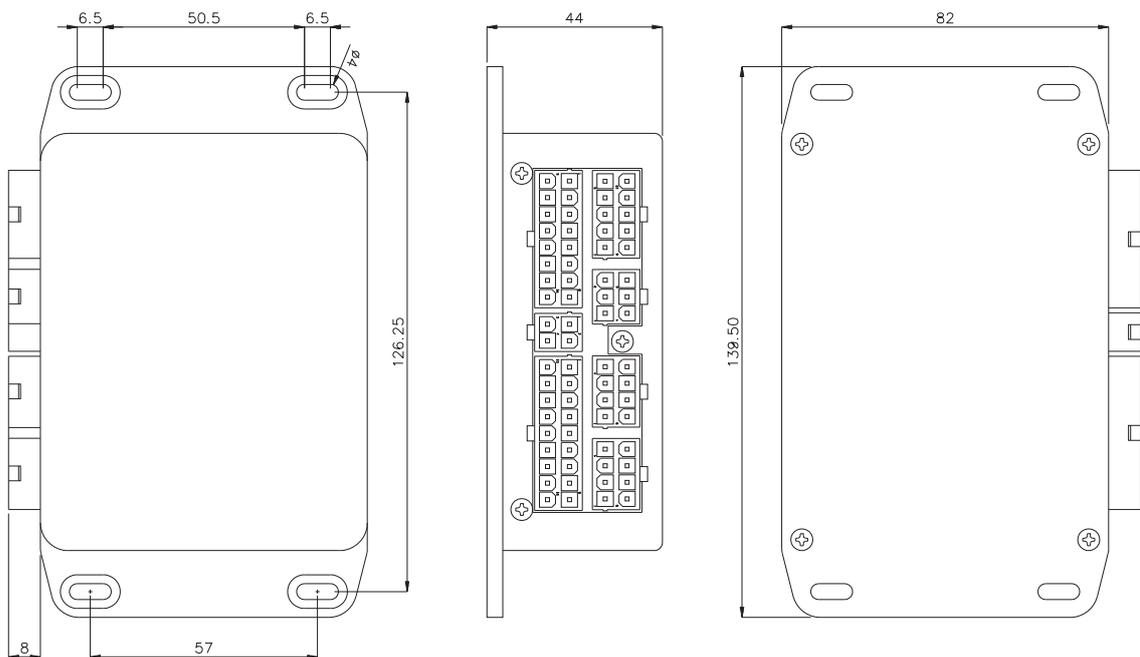
TECHNICAL FEATURES

Supply voltage from 12VDC to 80VDC
 Operating temperature from -40°C to +85°C
 Integral fault detect LED
 Output on the connector for the fault LED

FUNCTIONAL DIAGRAM



DIMENSIONS





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ISN BLACK BOX

The **Black Box** is a system designed to control the use of vehicles and record operating data and anomalies. It includes a "Logic Part", a "Display" and a "Current sensor".

The *Logic part* is housed in a IP65 metal box and is the system main part. It is equipped with a triaxial impact sensor and can accept a wide range of input voltages making installation very easy.

The *Display* includes a RFID reader and when connected to the logic part through a 2 mt cable included in the equipment is used to:

- 1 - receive signals from the transponders in the vicinity
- 2 - act as interface between PC and logic part using a simple USB cable
- 3 - act as audio-visual warning device to inform about possible anomalies
- 4 - supply power to the logic part during the data processing from PC through the USB cable.

The Hall effect *Current sensor* is easy to install and does not require changes to the original power wiring on the vehicle.

The **Black Box** system also offers options to guarantee high safety conditions for the user, including the vehicle lockout in case of impact when the pre-set values are exceeded, the main contactor opening in case of anomalous current draw, or the contact opening when the pre-set value for inclination is exceeded. In conditions like those just described the system also warns the operator with acoustic or visual signals through the *display* and records operating parameters. The data stored can be downloaded in Excel format connecting a PC to the *display*, in order to make the error analysis for the maintenance manager and the vehicle fleet controller simple and accurate.

When the **Black Box** is fitted on a vehicle it is possible to allow operation only to the user having the pre-stored RFID transponder thanks to the *display* reading function and in addition it is possible to identify the user and to check how the vehicle has been used. The system can handle the access of a large number of users through a password associated to each user profile in order to prevent the access to non authorized operators.

Max 200 users can be stored in the system. A user name can be associated to each transponder and the type of user can be set according to the profile used.

The **Black Box** can store the following data:

- 400 events for **Device switched on**, recording date, time, battery level, and hour meter each time the battery plug is connected and disconnected. In addition also Amps/hour used, max. current reached during operation and average current are stored. When more than 400 events have occurred, the last 400 ones are stored in the memory while the older ones are cancelled.

- 800 events including impacts, full battery indication, low battery indication, partial battery charge indication (opportunity charge), max. inclination allowed exceeded, and max. current draw allowed exceeded. The system errors indicate date, time, battery level, hour meter, state of the inputs, state of the outputs, cause for the event, user name and transponder number if present, acceleration value for the 3 axis, vehicle inclination and current draw by the battery. When more than 800 events have occurred, the last 800 ones are stored in the memory while the older ones are cancelled.

- 600 events for **User presence** recording date, time, battery level when the user starts operating the vehicle and when the user leaves the vehicle, partial hour meter, Amps/hour used, max. current, average current, user name and transponder number. When more than 600 events have occurred, the last 600 ones are stored in the memory while the older ones are cancelled.

~~NEWS~~**TECHNICAL SPECIFICATIONS****Logic part**

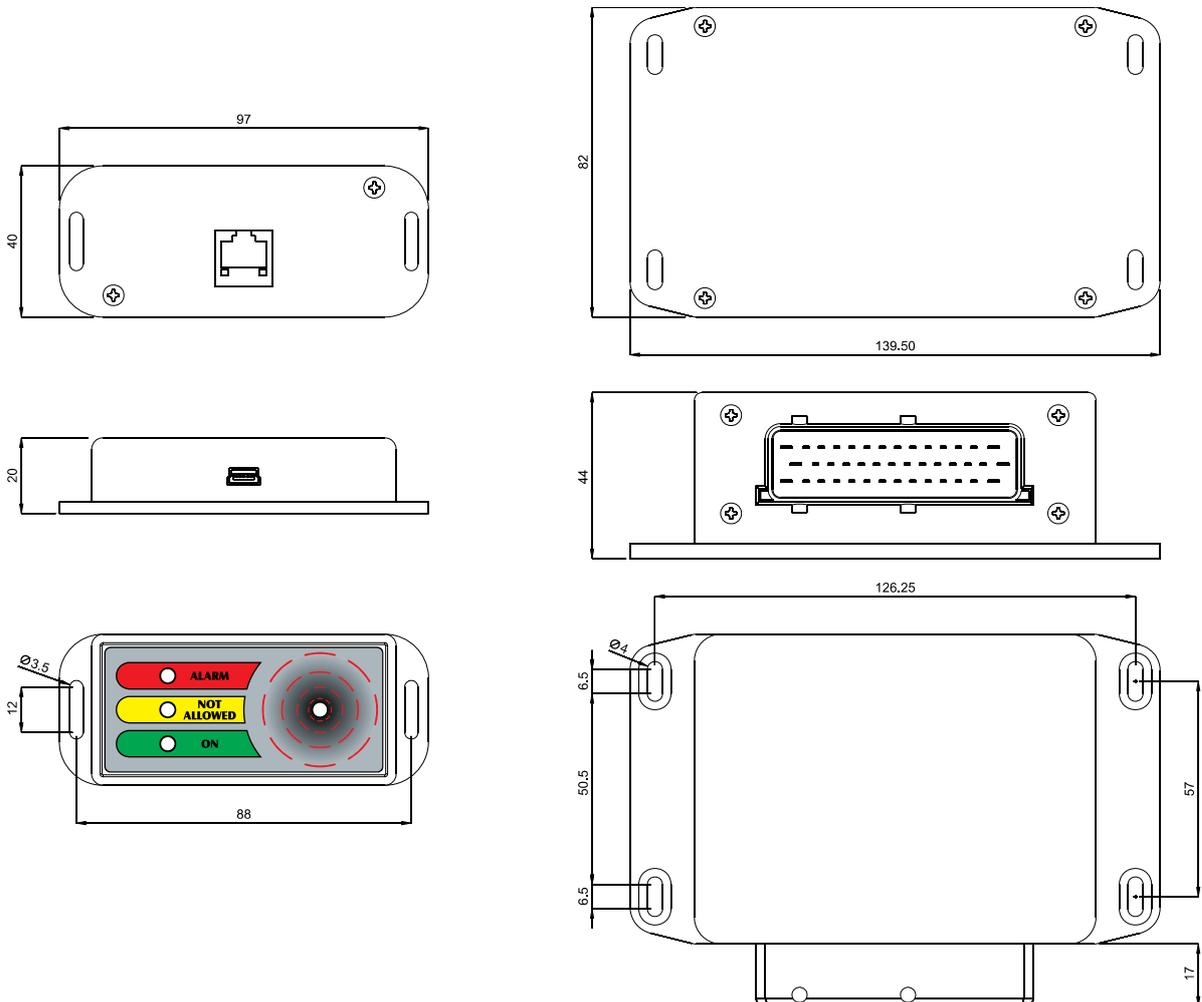
PARAMETER	VALUE			UNIT OF MEASUREMENT
	MIN	TYPICAL	MAX	
BOX	Aluminium housing, with flange			
DIMENSIONS	110 x 82 x 44			mm
PROTECTION RATE	IP65			
POWER SUPPLY	10		200	V
OPERATING TEMPERATURE	-25		+85	°C
CURRENT DRAW	Min 14 - Max 260			mA
RTC BATTERY	1			Lithium CR1220
PROCESSOR	8 bit, 8051			
PROGRAM MEMORY	64			Kb
PROCESSOR FREQUENCY	50			Mhz
DATA MEMORY AND PARAMETERS	256			Kb
(NO/NC) RELAY OUTPUTS				
NUMBER	4			
DC RATED VOLTAGE			250	V
CONTINUOUS LOADING CURRENT			8	A
INPUTS				
NUMBER	8			
INPUT IMPEDANCE			300	K Ohm
POSITIVE INPUT VOLTAGE	5		200	V
NEGATIVE INPUT VOLTAGE	0		1	V
MOSFET OUTPUT				
NUMBER	4			
RATED CURRENT			500	mA
DC RATED VOLTAGE			200	V
12bit ANALOGUE INPUTS				
NUMBER	2			
INPUT VOLTAGE	0		10	V
INPUT IMPEDANCE	1			M Ohm
ACCELEROMETER				
NUMBER OF AXES	3			
MAX ACCELERATION PER AXIS	-6		+6	G
INTERFACE				
SPI FOR THE LOGIC PART	1			
CANBUS	1			

~~NEWS~~

Display

PARAMETER	VALUE			UNIT OF MEASUREMENT
	MIN	TYPICAL	MAX	
BOX	black ABS housing, with flange			
DIMENSIONS	80 x 40 x 20			mm
PROTECTION RATE	IP42			
POWER SUPPLY		5		V
OPERATING TEMPERATURE	-25		+85	°C
TRASPONDER READER				
FREQUENCY	125			KHz
SUPPORTED TRASPONDERS	EM4000 - HitagS - Hitag1 - Hitag2			
INTERFACE				
SPI for the logic part		1		
USB 2.0 for Host		1		

DIMENSIONS AND MOUNTING HOLES





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ELC

CONTROLLO LIVELLO ELETTROLITA

ELECTROLYTE LEVEL CHECK



Lo strumento ELC è stato studiato per monitorare il livello di liquido presente nella batteria. L'analisi viene svolta prendendo come riferimento a campione un'elemento nel quale viene inserita una sonda, necessaria al dispositivo per valutare il livello.

Per il corretto funzionamento dello strumento è indispensabile una tensione d'alimentazione di 12V. E' possibile prelevare questa tensione da 6 elementi elettricamente connessi in serie tra loro sul pacco di batterie.

Il prodotto viene fornito in kit pronto per l'installazione sulla macchina ed è composto dal seguente materiale:

- Strumento ELC
- Sonda di rilevamento livello acido
- Connettori per cablaggio

INSTALLAZIONE

L'utente dovrà scegliere su quale elemento inserire la sonda, considerando che il polo Negativo di questo elemento sarà il Negativo dell'alimentazione 12V necessaria al dispositivo per il funzionamento.

Scelto l'elemento, si dovrà realizzare un foro di diametro 8mm nella parte superiore del tappo di rabbocco per installare la sonda. Una volta inserita la sonda nel tappo è necessario serrare i dadi in nylon per assicurare la sonda al tappo.

L'asticella in acciaio corre dentro al supporto di nylon e permette di effettuare la regolazione del livello. A questo punto è sufficiente regolare l'asticella metallica della sonda in modo tale che tocchi nella soluzione elettrolitica fino al livello minimo suggerito dal costruttore della batteria.

FUNZIONAMENTO

La parte metallica della sonda, se installata correttamente, tocca la soluzione elettrolitica fino a che non scende sotto il livello minimo. In questa condizione lo strumento ELC indica con Led Verde acceso fisso che all'interno dell'elemento è presente una quantità di liquido superiore rispetto alla soglia minima fissata.

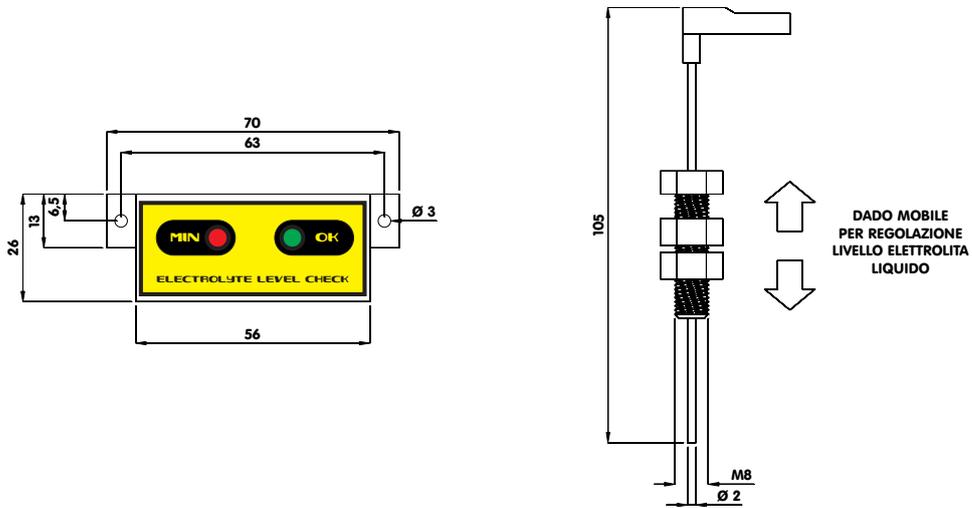
Nel caso in cui il livello della soluzione elettrolitica scenda sotto la soglia minima fissata, il Led Verde inizia a lampeggiare in modo continuativo per 8 secondi e contemporaneamente il Buzzer interno allo strumento emette un segnale sonoro.

Se entro questi 8 secondi il livello torna alla normalità (potrebbe essere sceso solamente per una inclinazione della macchina) il buzzer smette di suonare e il Led Verde torna fisso.

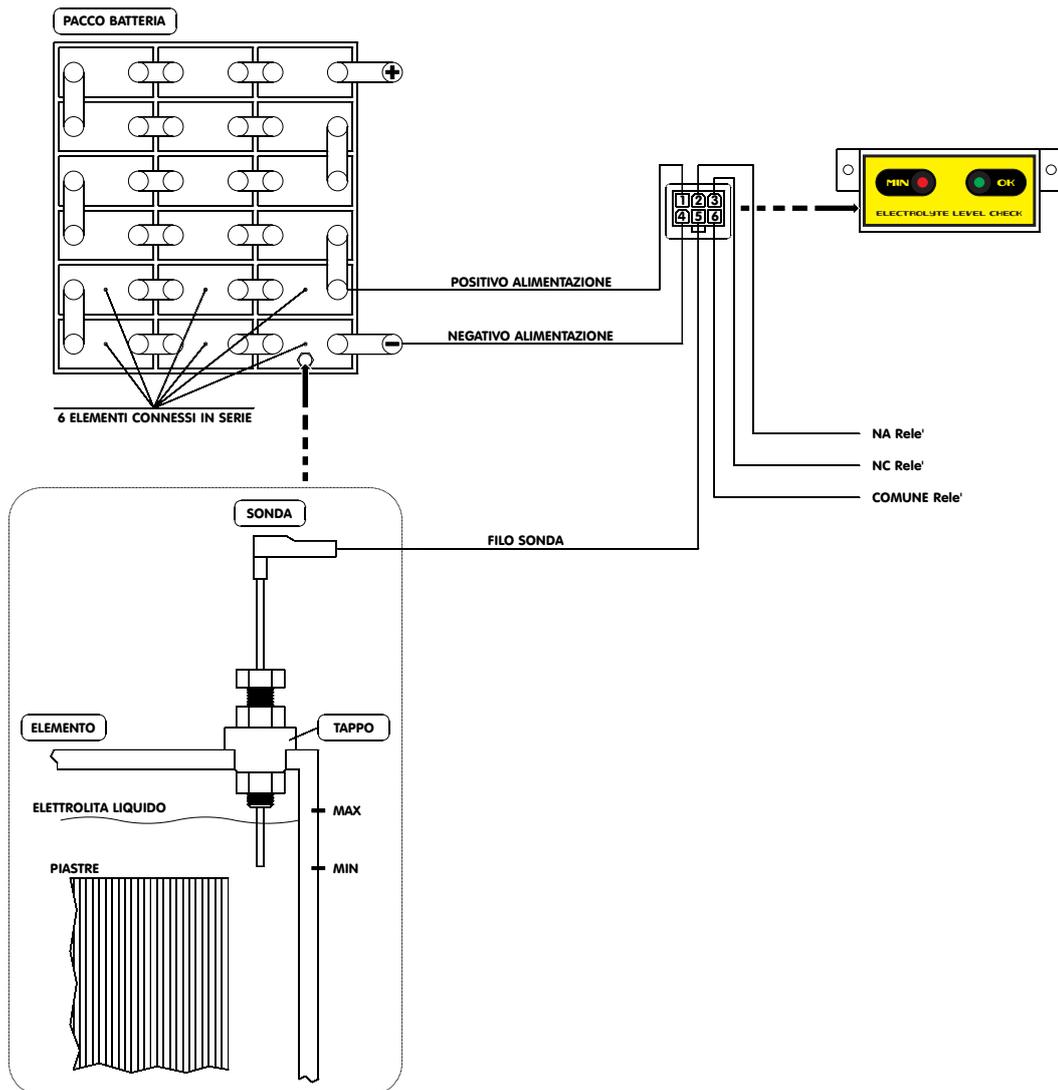
Se questa situazione perdura per un tempo superiore agli 8 secondi, il Led Verde cessa di lampeggiare ed al suo posto si accende quello Rosso che insieme al Buzzer continua a segnalare l'anomalia. In questa condizione viene eccitato anche un apposito relè interno allo strumento ELC che associato ad una funzione permette di ottenere ulteriori segnalazioni per l'operatore o il blocco della funzione.

~~NEWS~~

INGOMBRI MECCANICI



SCHEMA DI COLLEGAMENTO



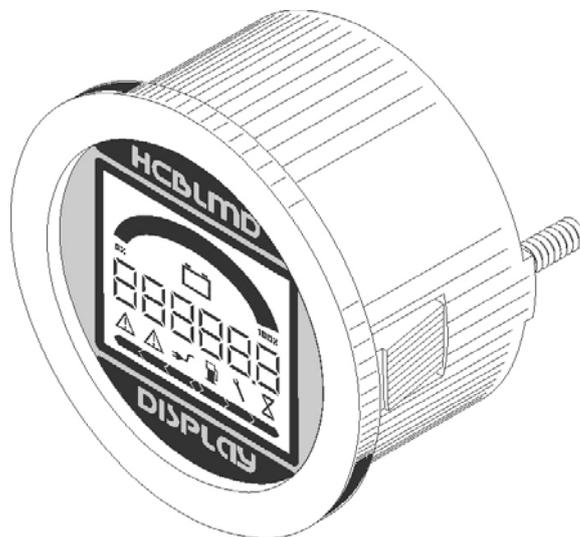


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HCBLMD

MULTIFUNCTION INDICATOR WITH LCD DISPLAY



Elektrosistem HCBLMD indicator combines different instruments in one device.

First of all it is a multivoltage microprocessor based battery level indicator with LCD display. The battery level is indicated by the length of the segment bargraph including 0% and 100% icons, the indication is accurate and is not affected by voltage drops that can cause errors in readings.

The charge percentage is stored in the memory when the key is switched off. The battery level is controlled through a flexible algorithm making it specially accurate in monitoring the discharge level, thus increasing battery life.

HCBLMD indicator also displays operating hours thanks to an hour meter with controlled counting. When the indicator is connected and the pins are energized the recorded hours of use are displayed. A flashing hour-glass icon indicates the hour meter is recording.

In addition HCBLMD indicator is used to display maintenance messages to inform the operator about the need to carry out pre-set operations. The wrench icon becomes on when the pre-set operation hours have been reached.

In most applications controllers are generally located in positions difficult to be reached and the fault LED can not be seen by the operator. To make trouble shooting operations easier, the indicator can also be used to display error messages from an Elektrosistem motor controller.

Battery indicator operation - When connected the indicator reads the battery voltage to check whether the battery has been recharged. Reset is only possible when a battery voltage higher than or equal to the pre-set value is measured (standard reset voltage pre-set at 2.07V/cell).

The bar length decreases proportionally to the battery level and when 0% level is reached the bar becomes off and the battery icon flashes to warn the operator about the battery state.

The connector includes an output for the lockout function used to prevent the complete discharge of the battery that can damage it, reducing its life and capacity. An energy reserve is kept to protect the battery. Lockout occurs when the pre-set value for empty battery is reached and is signalled by the flashing battery icon. Operation is only restored when the battery is recharged.

Reset voltage, discharge curve and lockout voltage can be customized.

TECHNICAL FEATURES

- Microprocessor based operation
- Segment bargraph to indicate the battery level
- Lockout function with adjustable voltage
- Storage in EEPROM memory without need of additional battery
- Reverse polarity protection
- Standard 52 mm case

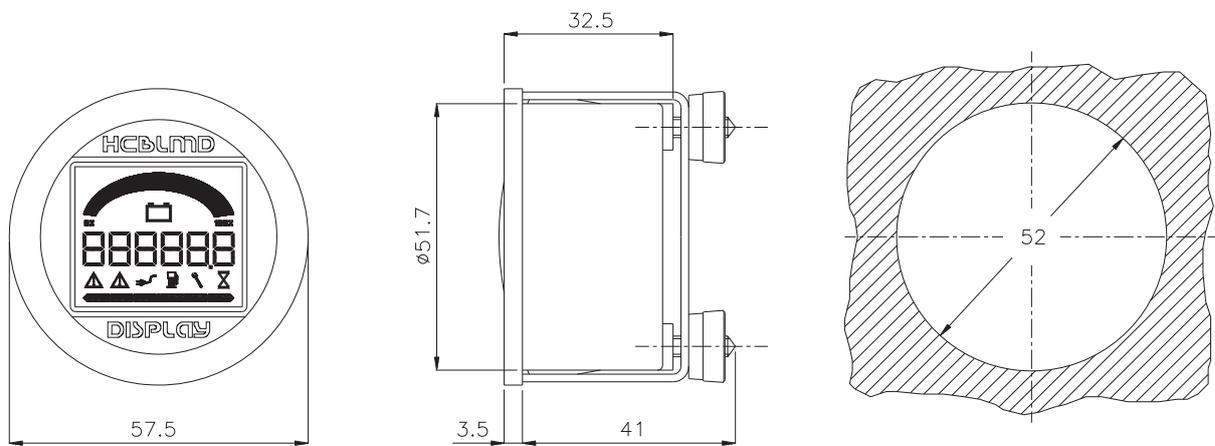


TECHNICAL SPECIFICATIONS

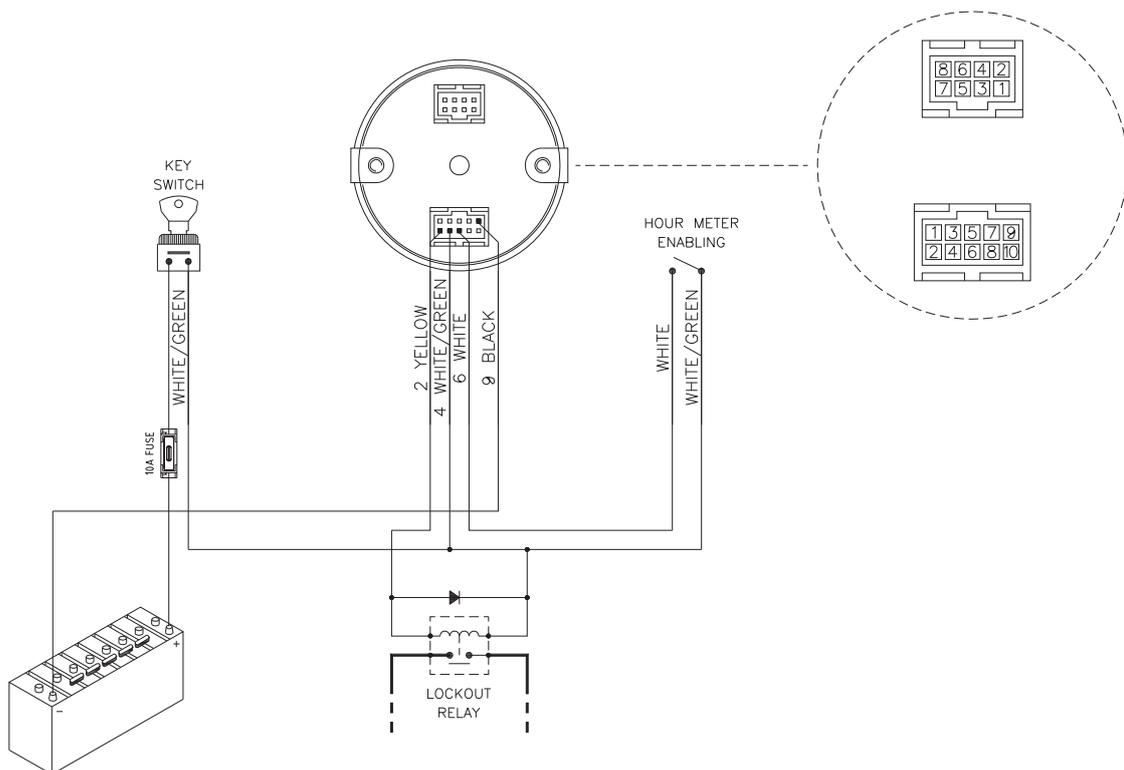
Operating voltage 12V or 24-30-36-48-60-64-72-80V
 Reset voltage 2.07 V/cell
 Current consumption lower than 10 mA
 Operating temperature -20°C +40°C

N.B. Data subject to changes without notice

DIMENSIONS



WIRING DIAGRAM



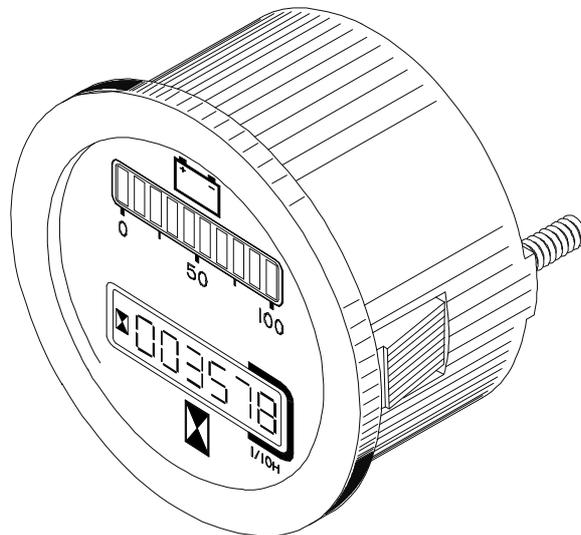


elektrosistem



HCBLM HCBLMR

MICROPROCESSOR BATTERY CHARGE INDICATORS WITH HOUR METER



The microprocessor aided battery charge indicators with digital hour meter series HCBLM and HCBLMR use a flexible algorithm to control discharging and can be used for all applications with a lead acid battery. HCBLM is a standard model whereas HCBLMR is equipped with a relay for lift lockout.

They are extremely precise in controlling discharge level and are therefore able to extend battery life.

OPERATION - Supply terminals must be connected between the battery negative wire and the positive wire coming from the key switch. The indicator does not operate properly when directly connected to the battery, it should be series connected with the key switch. When switched on the in-

dicator measures battery voltage to check whether a charging process has occurred.

Battery charge indication can be reset only when battery voltage is at least 2.08 V/cell (battery charged). The length of the light bar decreases proportionally according to battery discharging. In the "R" model when 5% of charge level is reached the last LED begins flashing to signal the lockout until discharging is total, then the last two LEDs of the light bar flash alternatively and the lockout relay is excited.

It is important to bear in mind that a complete discharge of a lead acid battery causes damages that can limit battery life and capacity. In order to protect the battery this indicator blocks the operation preventing deep discharge.

TECHNICAL FEATURES

- Microprocessor aided indicator.
- Ten light bars for battery charge indication, each signalling 10% of charge level.
- Lockout controlled by a change-over relay (only for "R" model).
- Control of permanent memory on EEPROM, no buffer battery for storing.
- Protection against battery polarity inversion.
- Standardized case, 52 mm diameter.
- Possibility to fit an external wire on request to enable the digital hour meter (controlled in positive).

TECHNICAL SPECIFICATIONS

Running voltage	12-24-36-48-60-72-80-96V
Reset voltage	2.08 V/cell
Max. current absorbed	50 mA (60 mA only for R model)
Max. running temperature	-20°C +40°C
Max. relative humidity	90% at 25°C

Specifications subject to change without notice

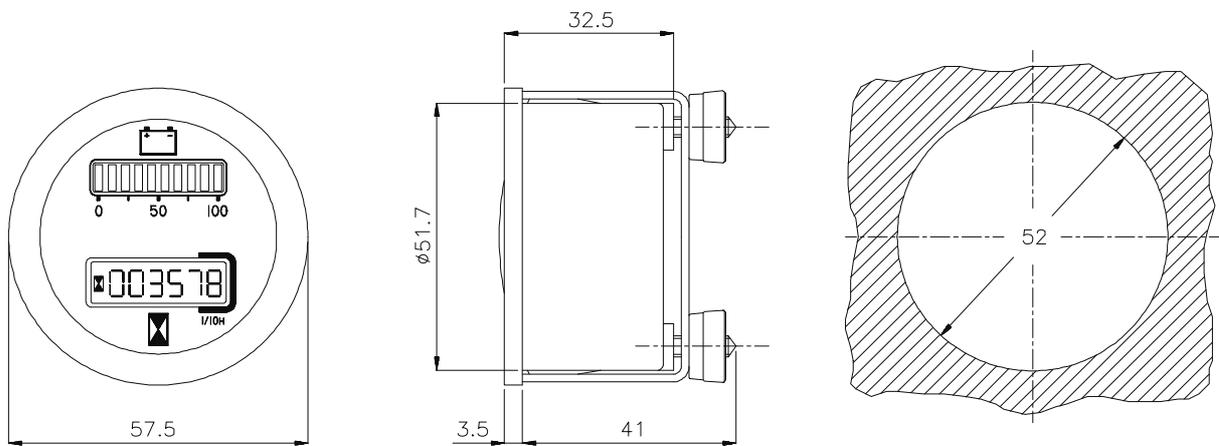


MODELS

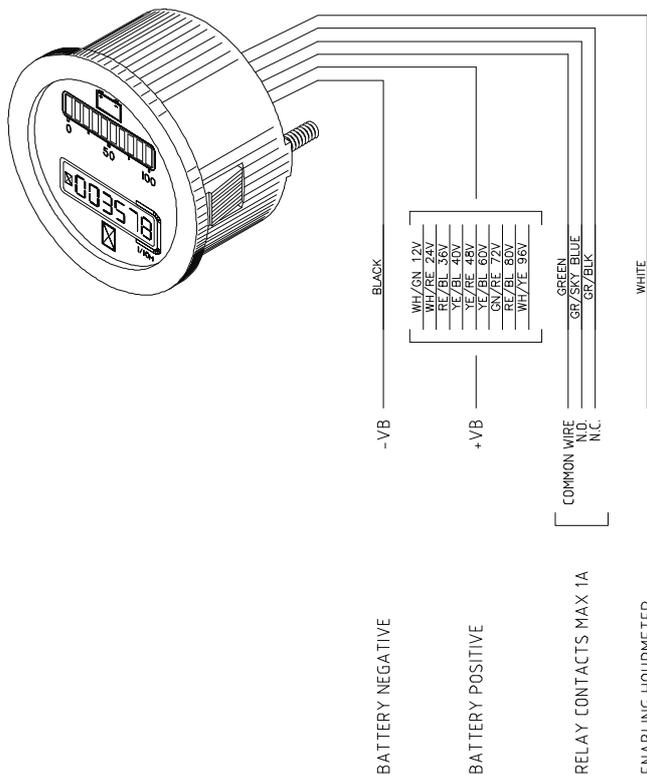
MODEL	12V	24V	36V	48V	60V	72V	80V	96V
HCBLM	•	•	•	•	•	•	•	•
HCBLMR *	•	•	•	•	•	•	•	•

* The lift lockout contact has a max. capacity of 1A at 24VDC.

DIMENSIONS



WIRING DIAGRAM



N.B. The data of lockout relay are referred to discharged battery.

To enable the hour meter connect the white wiring to battery positive.

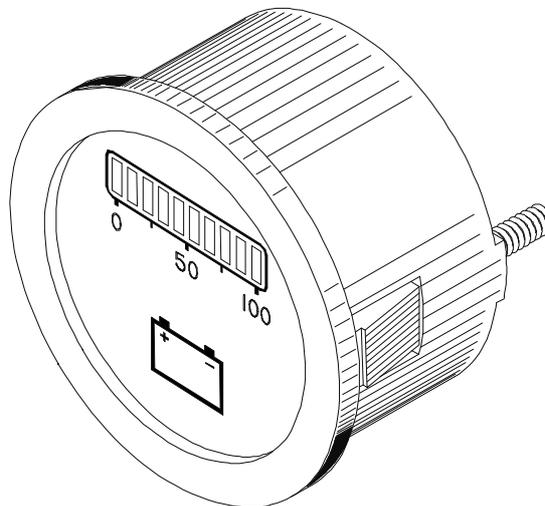


elektrosistem



CBLM CBLMR

MICROPROCESSOR BATTERY CHARGE INDICATORS



The microprocessor aided battery charge indicators series CBLM and CBLMR use a flexible algorithm to control discharging and can be used for all applications with a lead acid battery. CBLM is a standard model whereas CBLMR is equipped with a relay for lift lockout.

The indicators are extremely precise in controlling discharge level and are therefore able to extend battery life.

OPERATION

Supply terminals must be connected between the battery negative wire and the positive wire coming from the key switch. The indicator does not operate properly when directly connected to the battery, it should be series connected with

the key switch. When switched on the indicator measures battery voltage to check whether a charging process has occurred.

Battery charge indication can be reset only when battery voltage is at least 2.08 V/cell (battery charged). The length of the light bar decreases proportionally according to battery discharging. In the "R" model when 5% of charge level is reached the last LED begins flashing to signal the lockout until discharging is total, then the last two LEDs of the light bar flash alternatively and the lockout relay is excited.

It is important to bear in mind that a complete discharge of a lead acid battery causes damages that can limit battery life and capacity. In order to protect the battery this indicator blocks the operation preventing deep discharge.

TECHNICAL FEATURES

- Microprocessor aided indicator.
- Ten light bars for battery charge indication, each signalling 10% of charge level.
- Lockout controlled by a change-over relay (only for "R" model).
- Control of permanent memory on EEPROM, no buffer battery for storing.
- Protection against battery polarity inversion.
- Standardized case, 52 mm diameter.

TECHNICAL SPECIFICATIONS

Running voltage	12-24-36-48-60-72-80-96V
Reset voltage	2.08 V/cell
Max. current absorbed	50 mA (60 mA for R model)
Max. running temperature	-20°C +40°C
Max. relative humidity	90% at 25°C

Specifications subject to change without notice

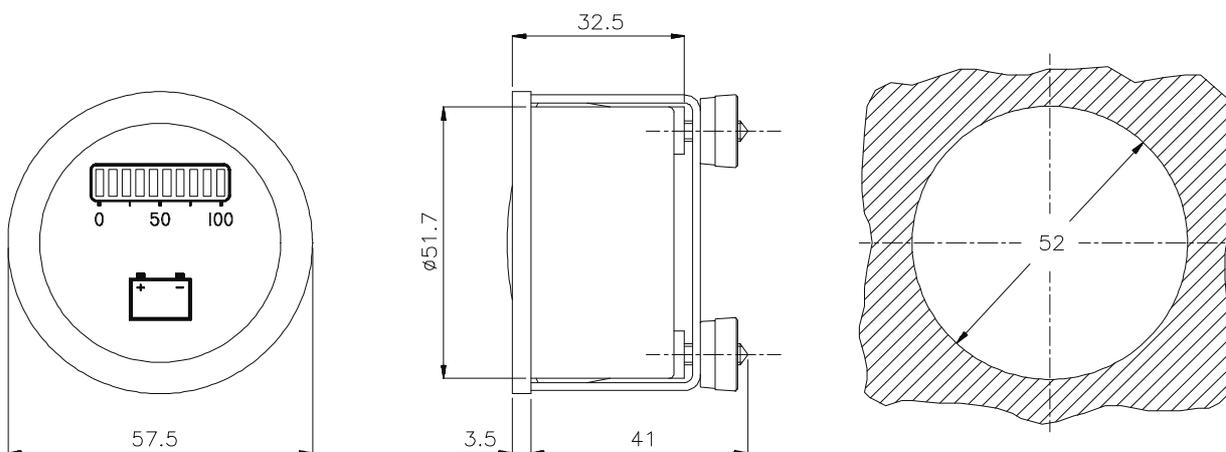


MODELS

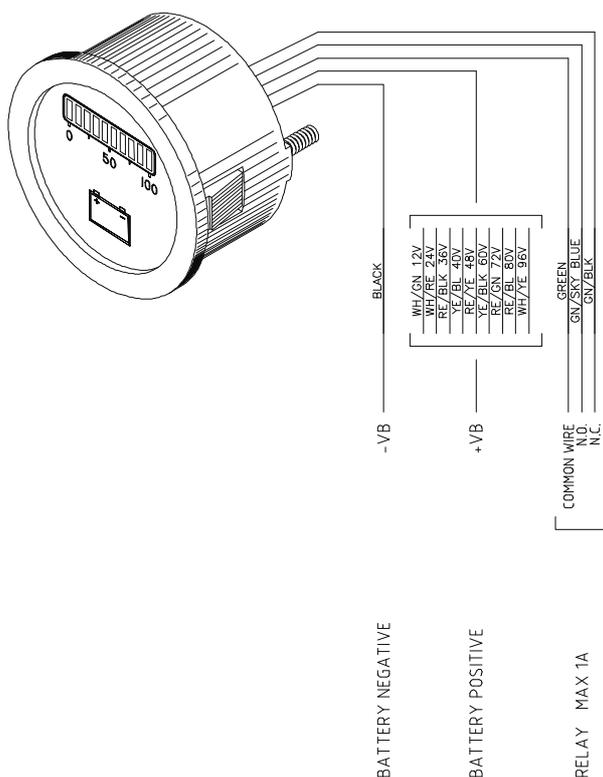
MODEL	12V	24V	36V	48V	60V	72V	80V	96V
CBLM	•	•	•	•	•	•	•	•
CBLMR *	•	•	•	•	•	•	•	•

* Lockout relay max. 1A at 24V.

DIMENSIONS



WIRING DIAGRAM



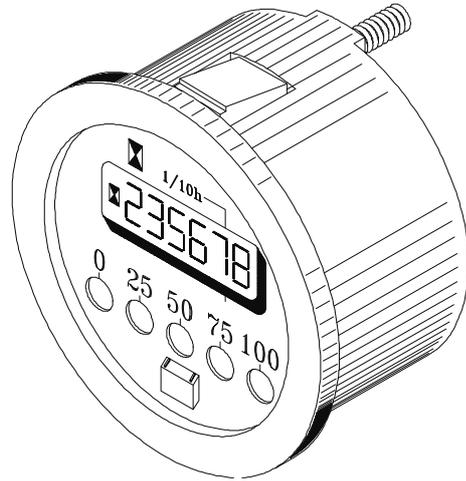
N.B. The data on lockout relay are referred to discharged battery.



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BATTERY CHARGE INDICATOR AND DIGITAL HOUR METER MODEL HCBL



The battery charge indicator with digital hour meter model **HCBL** is a new instrument that joins the wide range of products offered by **Elektrosistem**.

INDICATOR FEATURES

- Battery charge indication by means of 5 leds (1 red, 1 yellow, 3 green).
- Block of lift and other functions (by means of a relay) when discharge reaches 80%.
- Quartz electronic hour meter without battery equipped with liquid crystal display.
- Display of energizing (enabled keyswitch).

Technical features might be modified without notice.

FUNCTIONS

• Battery charge indicator

The continuous request for current to a battery causes voltage decrease at its ends. Analysis of shape and times of said decrease determines accumulator discharge condition.

Using all these parameters, Elektrosistem has designed the **HCBL** indicator.

This instrument precisely determines discharge comparing battery voltage with a pre-set value.

• Lift function block

The **HCBL** blocks lift and other functions when battery discharge reaches 80%. Block threshold is regulated during assembling but can be personalised according to requirements.

• Hour meter

The electronic LCD hour meter of **HCBL** is equipped with a special component that saves data in a non-volatile memory without any battery.

SPECIFICATIONS

- Standard battery voltages: 12,24,36,40,48,60,72,80,96 V
- Running temperature: from -40°C to +65°C
- Relative humidity: 95% at +38°C

RUNNING

- Battery indicator

1) When battery is charged all leds are on.

2) During discharging all leds go off one after the other from the right to the left.

3) When battery discharge reaches 80% only the red led remains on and the equipment is blocked.

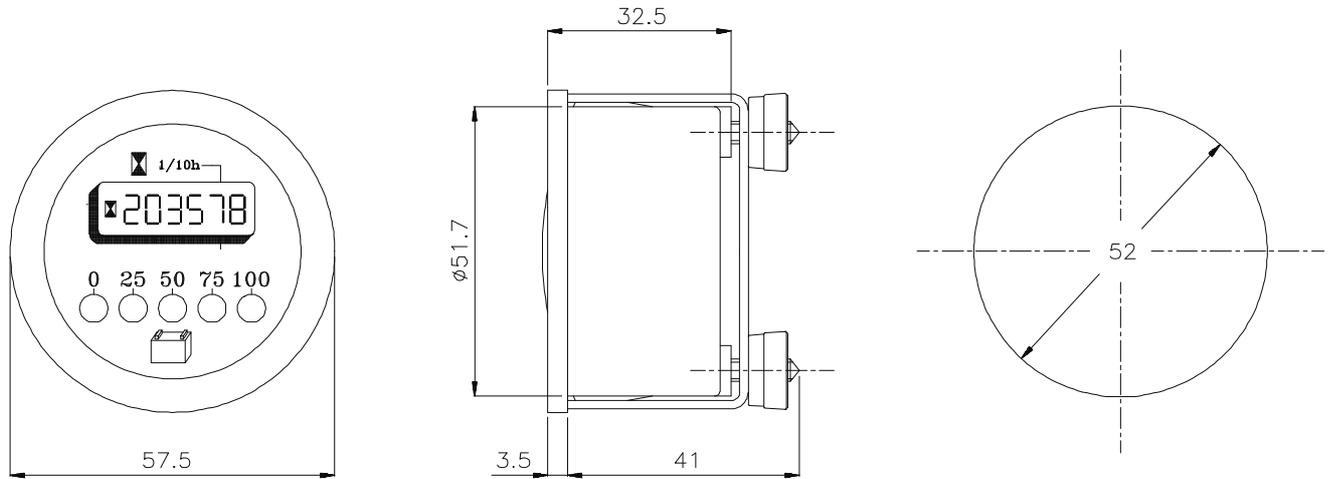
- Hour meter

1) Connecting the battery the total number of hours is displayed.

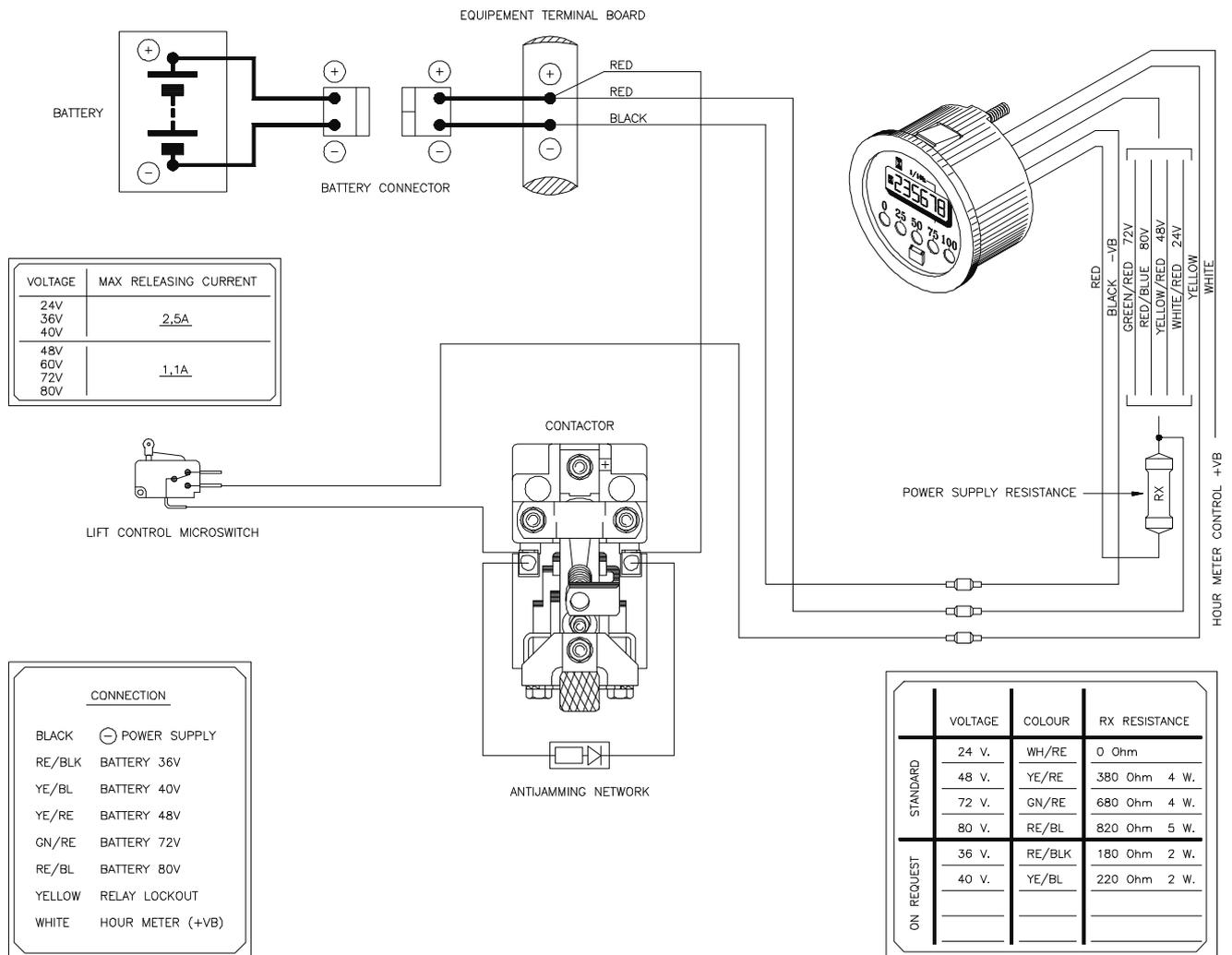
2) During running the hourglass of the instrument starts flickering counting hours.

~~NEWS~~

DIMENSIONS AND ASSEMBLY HOLE



WIRING DIAGRAM





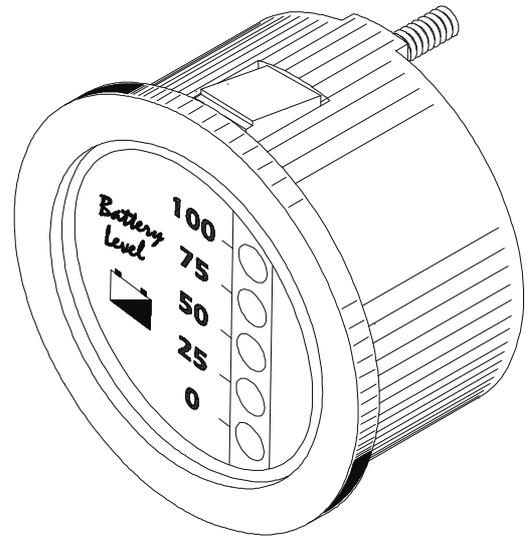
elektrosistem



BATTERY CHARGE INDICATOR MODEL

CBL

RUNNING VOLTAGE 12/96



The battery charge indicator model **CBL** is a new instrument that joins the wide range of products offered by **Elektrosistem**.

INDICATOR FEATURES

- Battery charge indication by means of 5 leds (1 red, 1 yellow, 3 green).
- Block of lift and other functions (by means of a relay) when discharge reaches 80%.

Technical features might be modified without notice.

FUNCTIONS

- Battery charge indicator
The continuous request for current to a battery causes voltage decrease at its ends. Analysis of shape and times of said decrease determines accumulator discharge condition.

Using all these parameters, Elektrosistem has designed the **CBL** indicator.

This instrument precisely determines discharge comparing battery voltage with a pre-set value.

- Lift function block

The **CBL** blocks lift and other functions when battery discharge reaches 80%. Block threshold is regulated during assembling but can be personalised according to requirements.

SPECIFICATIONS

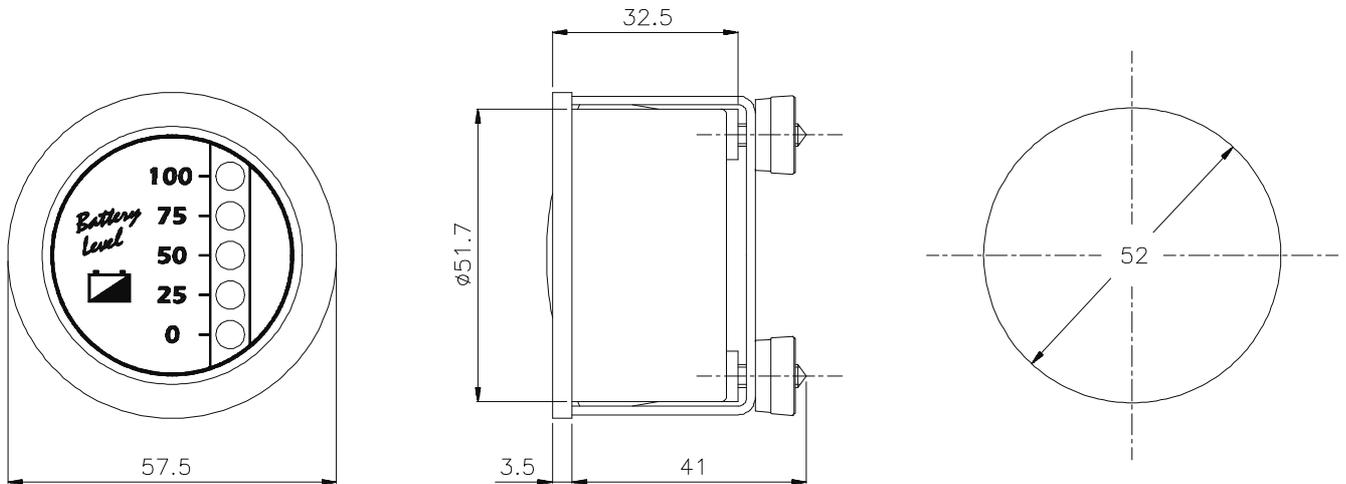
- Standard battery voltage: 12,24,36,40,48,60,72,80,96 V.
- Running temperature: from -40°C to +65°C
- Relative humidity: 95% at +38°C

RUNNING

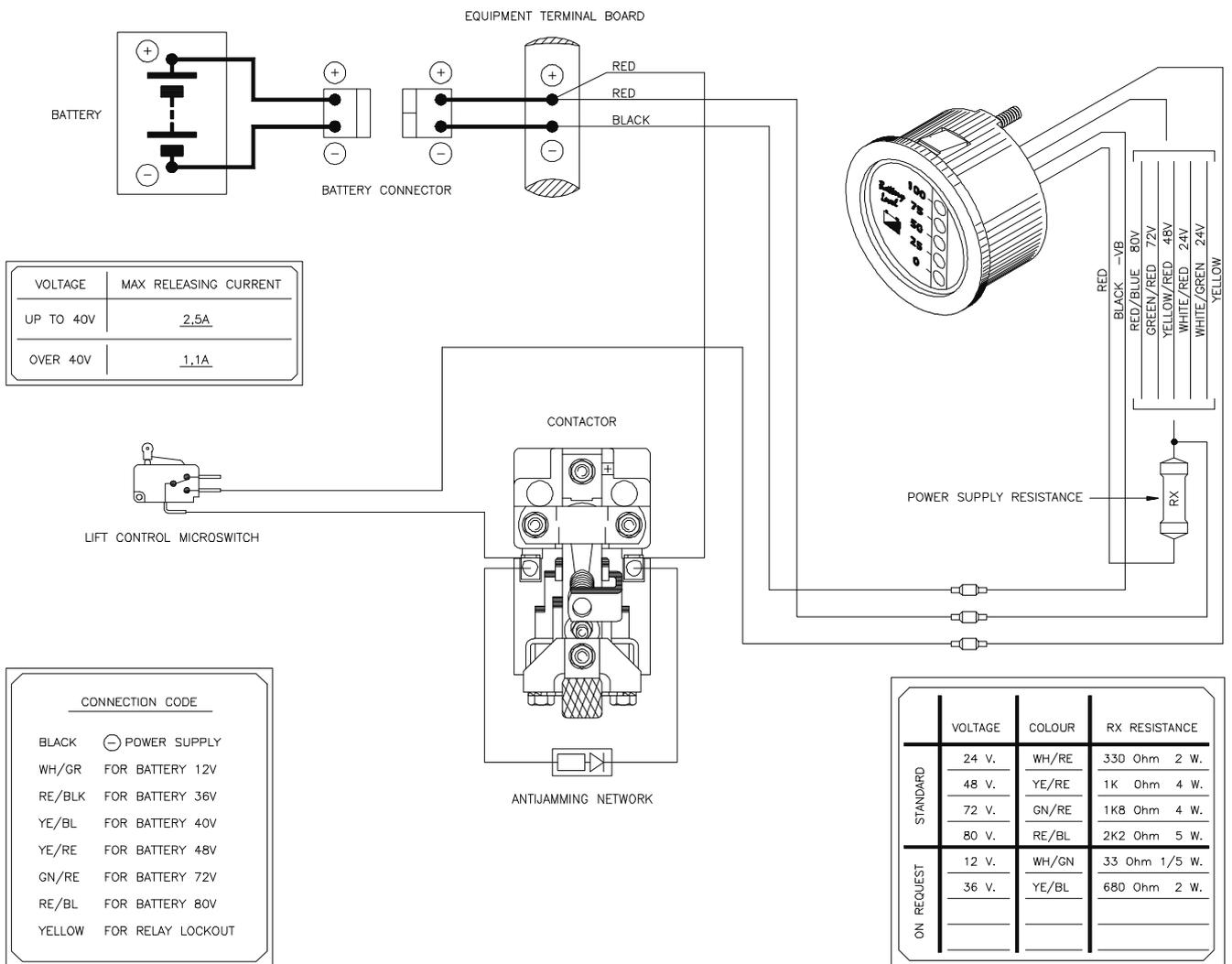
- 1) When battery is charged all leds are on.
- 2) During discharging all leds go off one after the other from up to down.
- 3) When battery discharge reaches 80% only the red led remains on and the equipment is blocked.

~~NEWS~~

MECHANICAL CLEARANCES AND ASSEMBLY HOLE



WIRING DIAGRAM





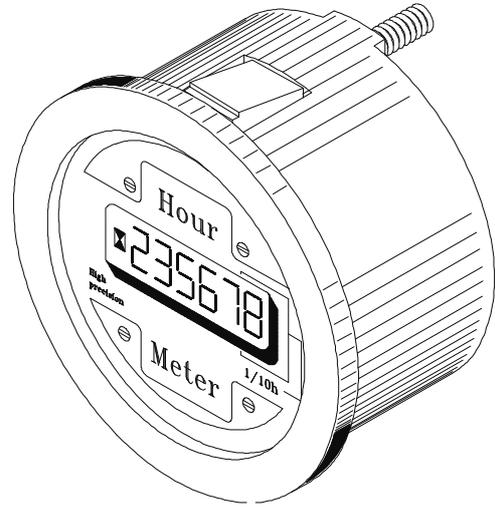
elektrosistem



DIGITAL HOUR METER

HCD-12/48

HCD-48/144



Elektrosistem's DC hour meters make use of a new technology based on a permanent eeprom memory and running without batteries.

This system is used for military applications and has two main advantages: high reliability and compact size.

The extreme versatility of the instrument allows applications in the various industrial fields: handling, battery vehicles, nautical industry.

The hour meter is available in two models: "with continuous counting" or "with controlled counting" with operating voltage from 12V to 144V.

OPERATION "with continuous counting"

- When the hour meter is connected to the battery it starts counting and displays the total number of hours stored.
- When voltage is supplied to the hour meter, the hourglass on the display flashes, indicating that it is counting hours.
- All data are stored in the permanent memory of the indicator even when voltage is interrupted.

OPERATION "with controlled counting"

- When the indicator is connected to the battery it displays the total number of hours stored but it does not start counting.
- The hourglass does not flash.
- It is necessary to connect the wire (white for positive control and yellow/black for negative control) to start counting.
- The hourglass starts flashing and the hour meter starts counting until the wire is disconnected.
- In this way it is possible to stop the hour meter counting without interrupting the voltage.
- All data are stored in the permanent memory of the indicator even in case of voltage interruption.

Technical features might be modified without notice.

TECHNICAL SPECIFICATIONS

Reading capacity	99999.9
Resolution	0.1 hours
Precision	±0.04 % (from -40 °C to +85 °C)
Max. absorbed current	1 mA
Operating temperature	from -40 °C to +85 °C
Storage temperature	from -50 °C to +90 °C

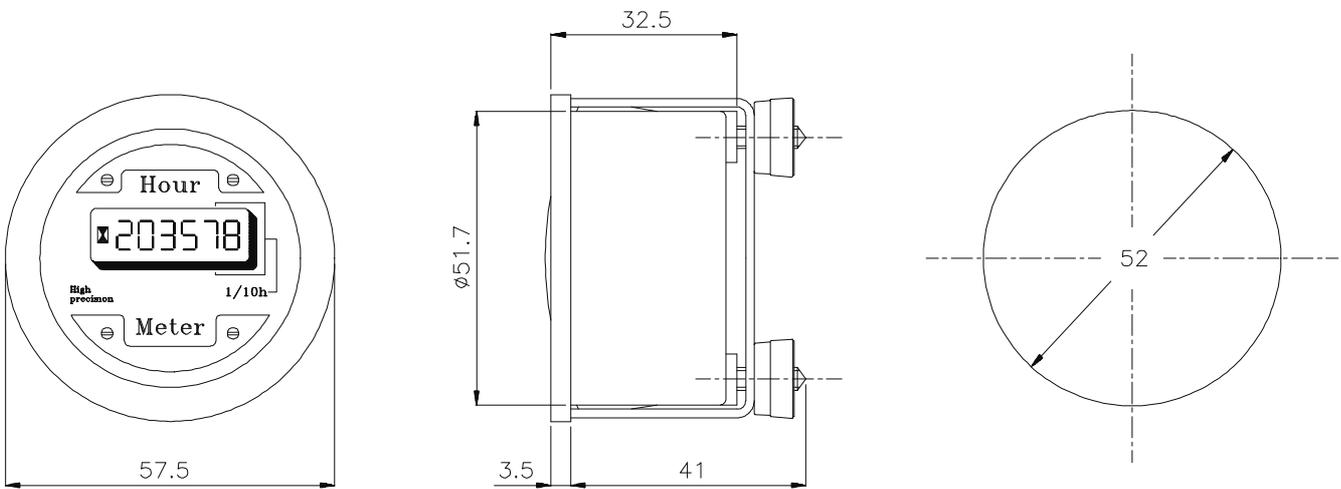


MODELS

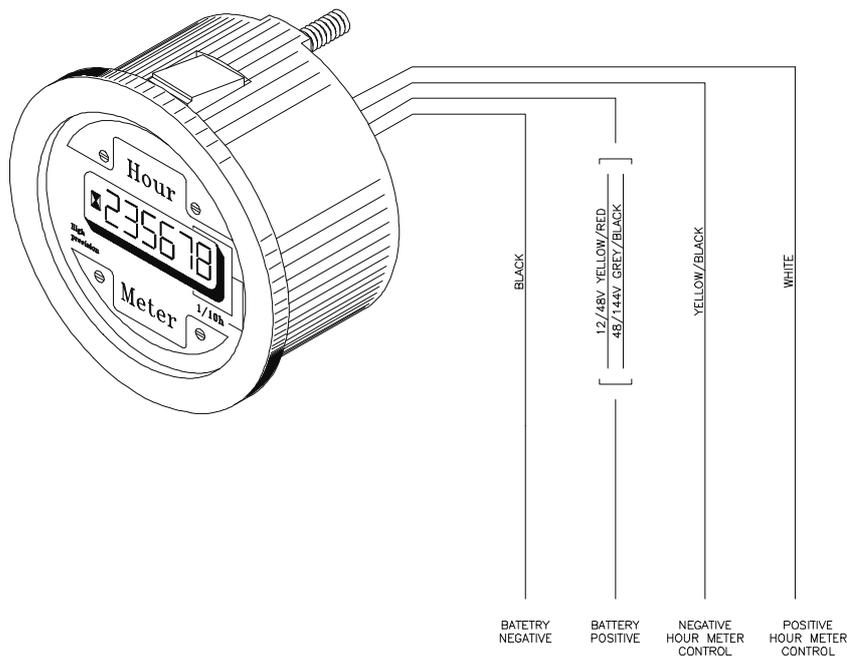
Model	12V	24V	36V	48V	60V	72V	80V	96V	120V	144V
HCD-12/48	•	•	•	•						
HCD-48/144				•	•	•	•	•	•	•

Both models are available without control, with positive or negative control and with both controls.

DIMENSIONS

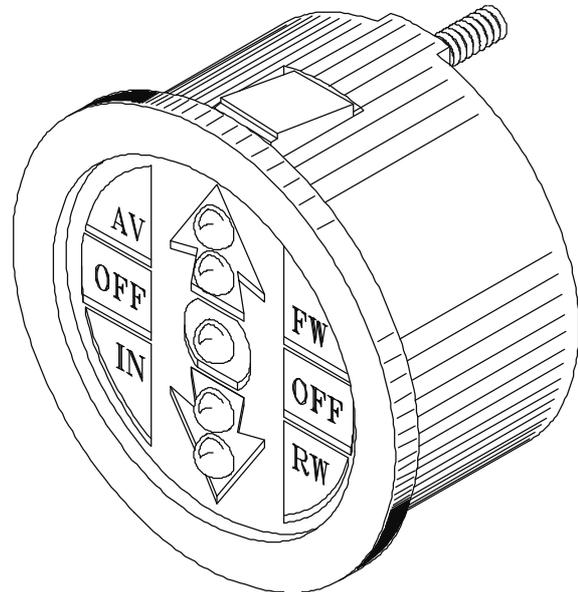


WIRING DIAGRAM





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DIRECTION INDICATOR MODEL IDM-12/80

The new EEC standard concerning handling has created the need for instruments dedicated to the security of users and of those people working with or near handling machines.

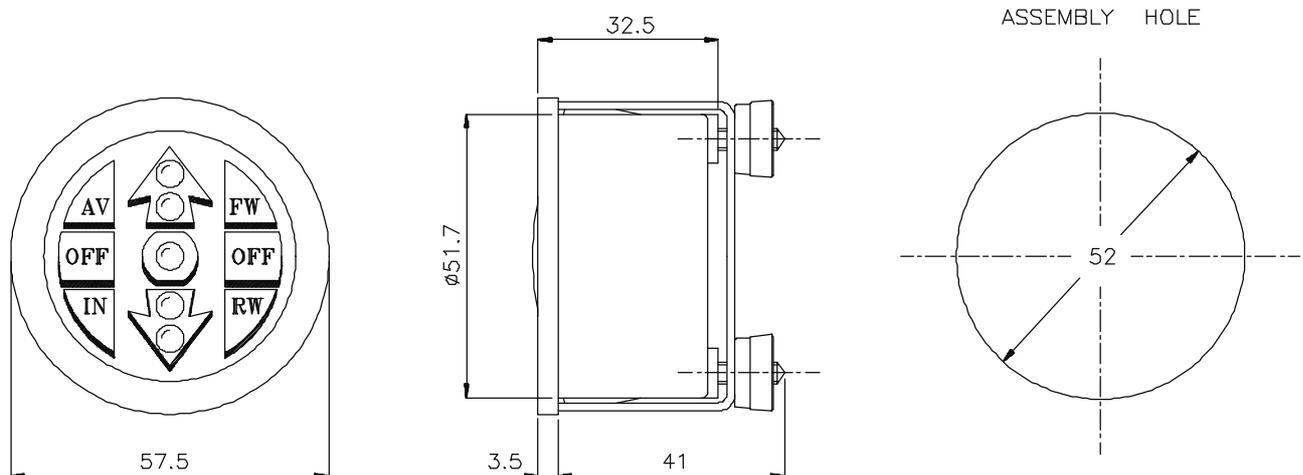
For this reason ELEKTROSISTEM has designed an instrument that allows operators to know the selected direction before pushing the pedal and avoids stupid accidents.

The indicator shows the selected direction (forward or backward) by means of red leds and rest position by means of a green led located at the centre of the instrument.

The indicator is supplied in a single multivoltage version (12/80 VDC).

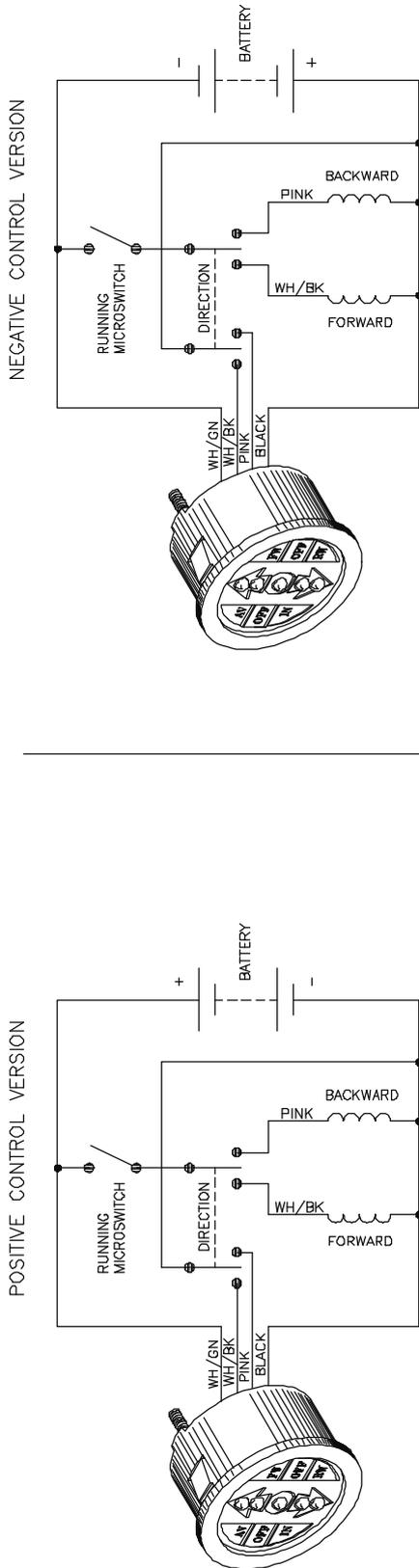
NOTE: In case of lift trucks with two pedals, the instrument signals direction only when one of the pedals is pushed.

DIMENSIONS AND ASSEMBLY HOLE

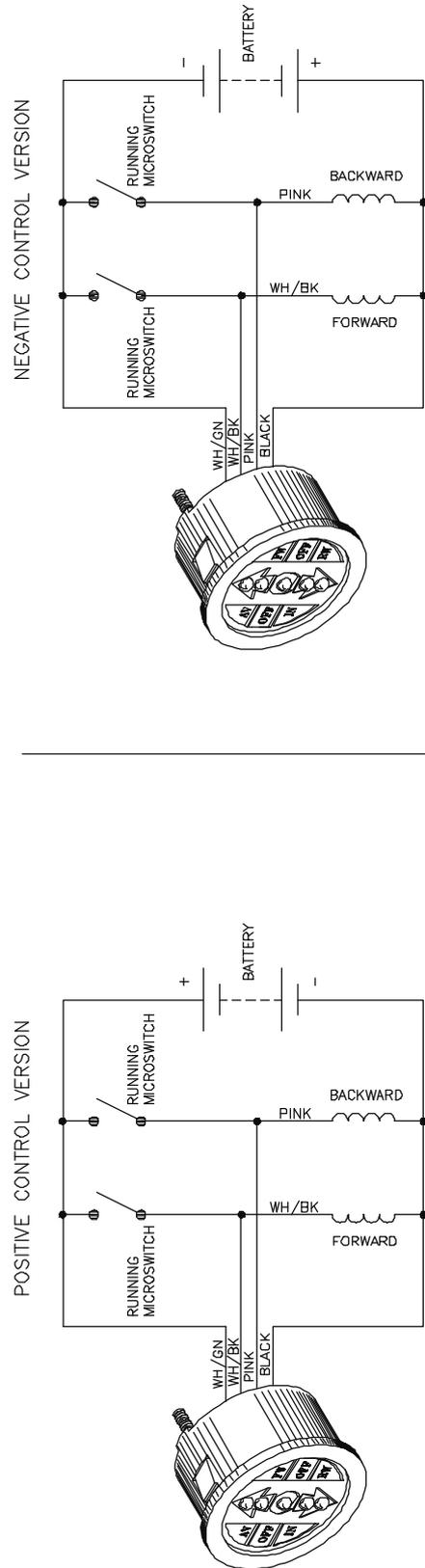


NEWS

IDM WIRING DIAGRAM WITH DIRECTION SWITCH



IDM WIRING DIAGRAM FOR FOOT PEDAL WITH TWO PEDALS

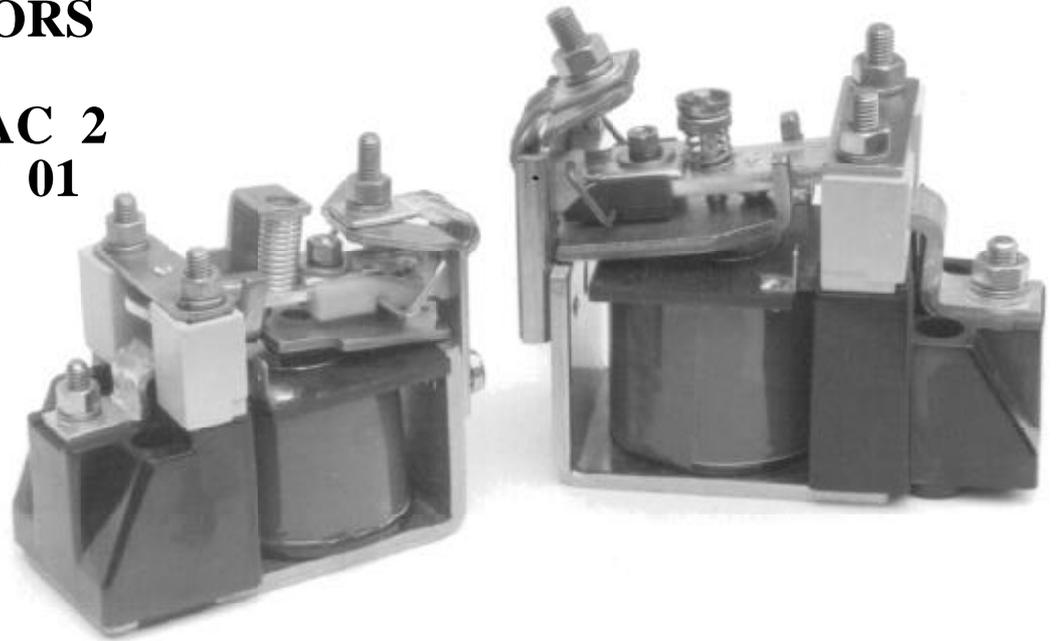




elektrosistem



UNIPOLAR CONTACTORS SERIES MAC 1, MAC 2 AND MAC 01



The unipolar contactors series MAC 1 - MAC 2 and MAC 01 have been specially designed for high performance services and for those applications in which high reliability and precision are required.

Their simple and strong structure enables easy inspection and maintenance, that is direct access to the single internal parts without disassembling the equipment.

All metal parts including bolts and nuts and springs have been tropicalized in order to be protected against oxidizing agents, while insulating materials have been realized in synthetic fiber and are mould-proof and self extinguishing.

The contactors series MAC 1 - MAC 2 and MAC 01 have been conceived for applications up to 120 VDC and in particular to be fitted on lifting trucks, electrical vehicles, railway equipment, electric welding machines, etc...

Thanks to their simple and strong mechanical structure as well as their precise assembling these contactors are resistant to shocks and vibrations and

may work in all positions. Moreover, their special mobile structure avoids early wear and seizure and at the same time allows utilization in cold rooms without the risk of ice formation on the central core.

In designing the models MAC 1, MAC 2 and MAC 01 a particular attention has been paid to poles conformation, in order to obtain an effective self-cleaning action, the total absence of rebound effects and a low contact resistance. These features have been made possible thanks to different factors, such as the rubbing action between the surfaces of the power contacts, their particular form, the type of load springs used and the installation of high-performance anti-arc devices (i.e. kit of magnetes).

The control magnet circuit has been designed to ensure that opening and closing of the contactor is always carried out in a single phase, thus avoiding noising rebound effects, even when slightly variable voltages are present.

The particular conformation of these contactors also ensures a marked

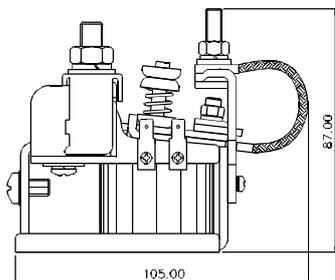
pressure on the contacts. The contactors mod. MAC 1, MAC 2 and MAC 01 are available with a single closing pole (type D) and also with an inverting pole (type R). They may be completely disassembled in order to allow easy maintenance.

Every component of our MAC contactors is available as spare part and may be completed with a back support for the control of one or more auxiliary contacts.

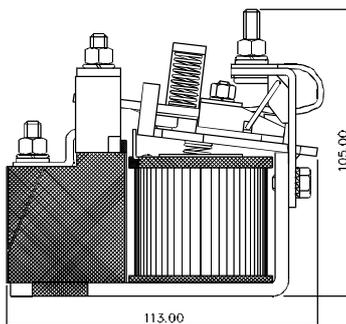
These contactors may be modified to work from permanent to intermittent duty by simply replacing the coil.

Technical features might be modified without notice.

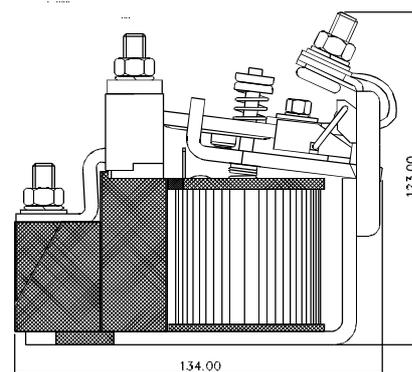
NEWS



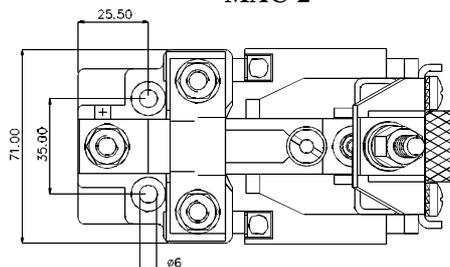
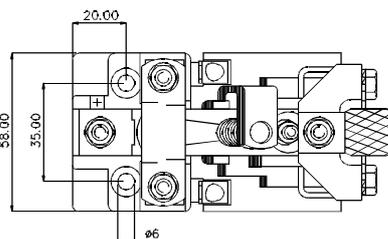
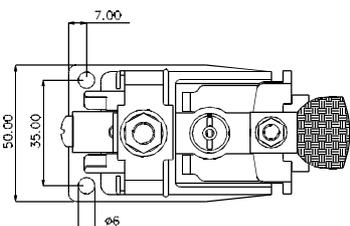
“MAC-01”



“MAC-1”



“MAC-2”



Features

TYPE		MAC-01	MAC-1	MAC-2	
DC1(1) Operation Current (Free Air) With Poles Connected	-permanent duty	A 165	180	240	
POLES BY:	-lift-truck duty (50% duty cycle)	A 230	250	310	
35mmq for MAC1 and 70mmq for MAC2	-5 min open 5 min closed	V ≤120	≤120	≤120	
VOLTAGE RATING: magnetic blowout for V>48V		min 15	18	18	
TIME CONSTANT FOR POLE TEMPERATURE					
OPENING AND CLOSING POWER					
closing pole	-D version	closing	A 900	900	2000
	for V ≤96V	opening	A 900	900	1200
INVERTING POLE					
normally open contact	-R version	closing	A 900	900	2000
	for V ≤96V	opening	A 900	900	1200
normally closed contact	-R version	closing	A 400	400	550
	for V ≤96V	opening	A 200	200	500
MAXIMUM RATINGS		operations/hour	300	300	300
DRIVE CIRCUIT (COIL)					
permanent duty	-admitted voltage variation	%Vn	85e110	85e110	85e110
	-disconnecting voltage	%Vn	20	20	20
	-power consumption at Vn	W	25	25	32
intermittent duty (lift-truck)	-voltage variation	%Vn	65e110	65e110	65e110
	-disconnecting voltage	%Vn	15	15	15
	-power consumption at Vn	W	44	44	53
	-duty cycle	%	50	50	50
	-maximum cycle time	s	150/150	150/150	150/150
OPERATION TIME AT NOMINAL VOLTAGE					
permanent duty	-closing	ms	55	55	75
	-opening	ms	15	15	16
intermittent duty (lift-truck)	-closing	ms	40	40	50
	-opening	ms	16	16	17
CONNECTIONS					
power	-connection size	mm	16x16	16x16	20x20
	-screws Ø	mm	6	6	8
coil	-spade	mm	6.35	6.35	6.35

- 1) DC1: No or slightly inductive loads (spiral resistor)
- DC2: Shunt motor starting and stopping
- DC4: Series motor starting and stopping

(*) When a strongly inductive load (DC4 standard) is used, it is necessary to use a free-wheel diode in antiparallel to the load.

Standard voltages:
12,24,36,40,60,72,80,96,110,120 V,
 on request different voltages are possible.

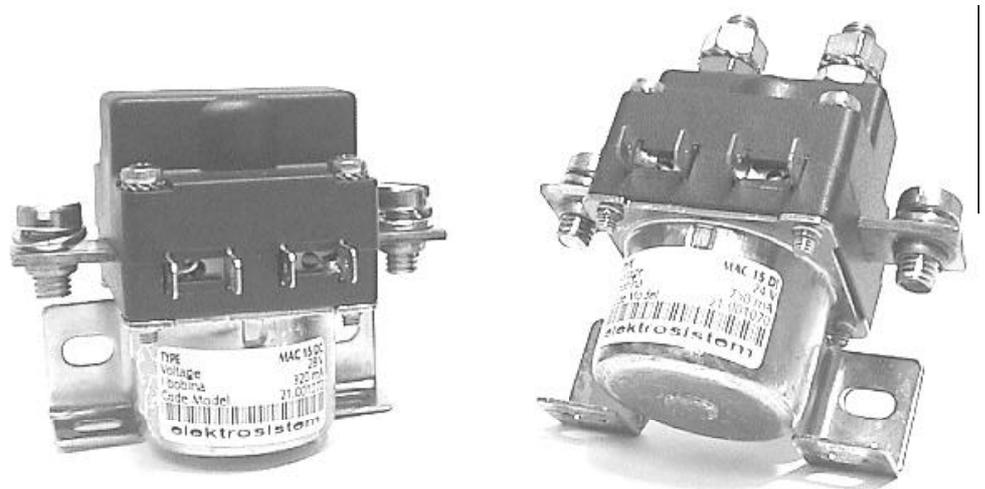


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UNIPOLAR CONTACTORS

“MAC-10”
“MAC-15”



The “MAC” series monoblock contactors are characterized by a strong interrupting power (insulation) and by small dimensions.

They are used for DC loads with operation voltages up to 96 VDC (DC1 duty) and are available with 1 (type D) or 2 (type R) contacts (INO+INC).

They are generally used for starting and drive of electric lift truck DC motors, remote control of battery supplied power circuits, drive of starting motors for combustion engines, power supply of board watercraft instruments, etc...

The squared assembly tongue enables every kind of assembly.

The contactors are provided with washers and screws for cables connections and with magnetic blowouts for voltages ≥ 48 VDC.

Coil and contacts can be easily inspected for maintenance and replacement.

The “MAC” series contactors are protected against dust and water sprays, can work in a wide temperature range (from -30° to $+60^{\circ}$ C) and have a maximum closing lag of 20 ms and an opening lag of 9 ms (that becomes 20 ms

with extra current peak extinguisher that is a resistance of 56 Ohm + diode).

USE:

For a correct use, a vertical assembly with the black head up for “D” type and with the black head down for “R” type is advised. Contacts must be connected according to fig. 1.

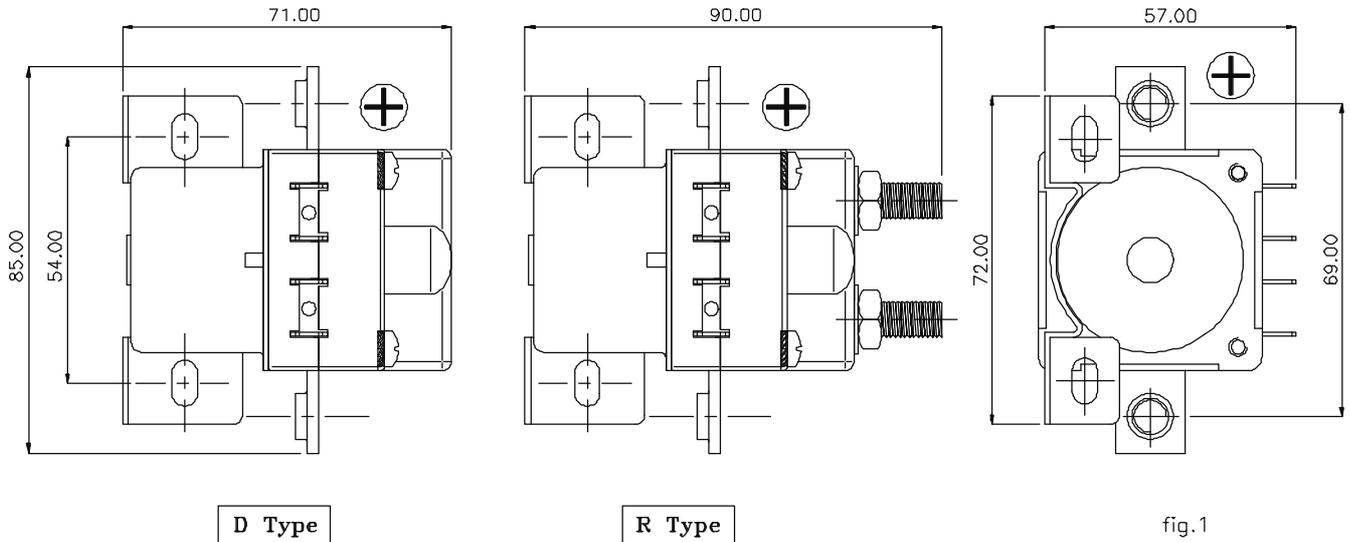
On request contactors having a different polarity than standard ones can be supplied.

For very inductive loads (DC2-DC4 duty), it is necessary to add a free-wheel diode (fig. 3).

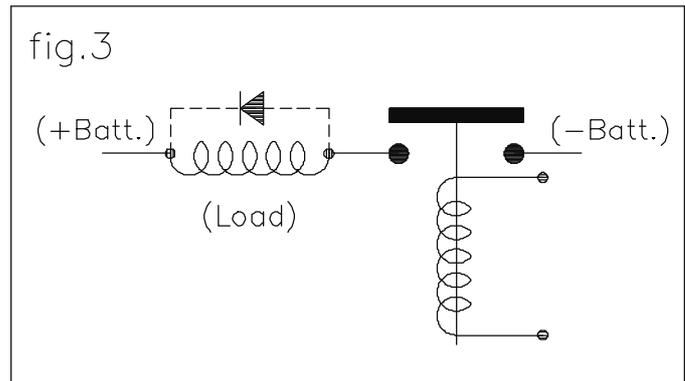
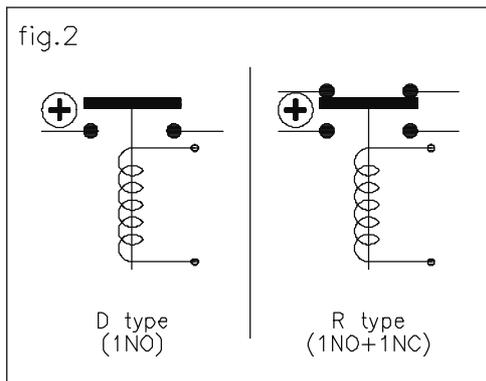
Technical features might be modified without notice.

NEWS

MECHANICAL CLEARANCES



WIRING DIAGRAM



CONTACTS AND COILS FEATURES

DC1 DUTY (Resistive load)

MAC	V	"N.O." CONTACT		"N.C." CONTACT	
		CONT.	SPUNTO	CONT.	SPUNTO
10-D	24/80	100	300	—	—
15-D	24/80	150	450	—	—
15-R	24/80	150	450	75	250

CONT.=MAX. CONTINUOUS CURRENT SPUNTO=STARTING CURRENT

Load on contacts can be increased up to 200% with a consequent shorter life of contactors.

- DC1: No or slightly inductive loads (spiral resistor)
- DC2: Shunt motor starting and stopping
- DC4: Series motor starting and stopping

ON REQUEST STANDARD

V	INTERMITTENT DUTY		CONTINUOUS DUTY	
	RES.20°C	20°C	RES.20°C	20°C
12	7,4	COIL POWER CONSUMPTION 19,5W AT 20°C OPERATIVE VOLTAGE AT 25°C FROM 60% TO 100% OF "VB"	13	COIL POWER CONSUMPTION 11W AT 20°C OPERATIVE VOLTAGE AT 25°C FROM 80% TO 110% OF "VB"
24	29,5		52,5	
36	66,5		118	
48	118		210	
60	185		327	
72	266		471	
80	328		582	
96	473		838	
108	582		1060	
120	838		1309	

For intermittent duty, work cycles of 10" (ON) and 60" (OFF) or 1' (ON) and 6' (OFF) are advised.

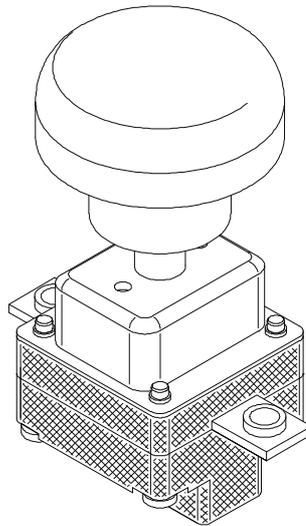


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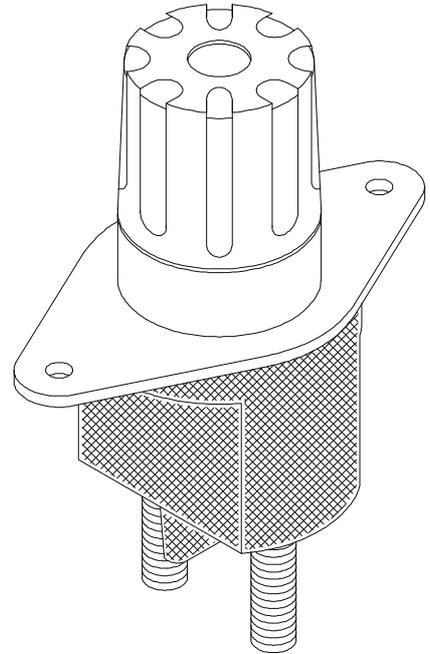
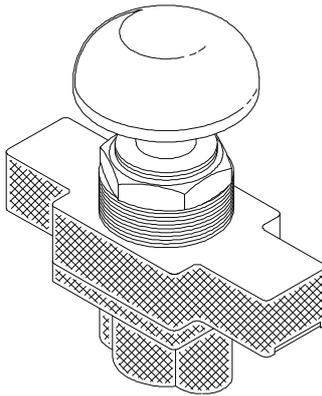


UNIPOLAR BATTERY DISCONNECTING SWITCHES TYPE BDS

BDS-200



BDS-150



BDS-250

FEATURES

The battery disconnecting switches type BDS have been designed for applications on electric vehicles to isolate the battery in case of serious anomalies and to protect the operator during maintenance operations on electric parts.

Switches are compact in size, easy to install and capable of disconnecting at full load; moreover the double opening contact guarantees high capacity and prevents jamming.

For the models BDS200 and BDS200S spare contacts are available.

For voltages over 48V switches are equipped with blowout magnetes fitted on the opening contact that enhance the arc rupturing capacity.

ASSEMBLING AND USE

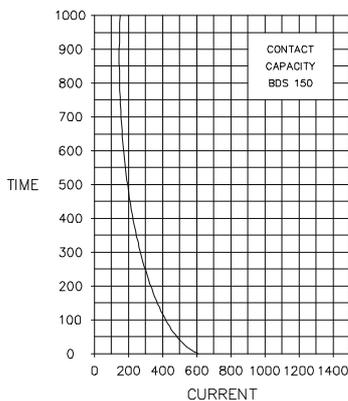
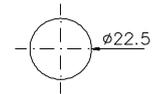
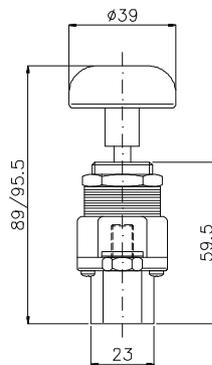
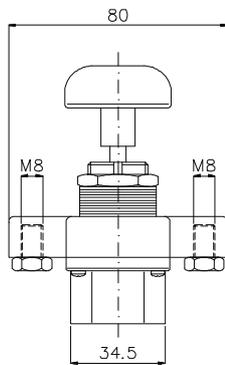
- Ensure that the switch is installed in such a position that electric arcs can not damage electric wires or other parts.
- Ensure that the cap is perfectly tightened.
- Never use for controlling the vehicle.
- No special maintenance is required, for safety purposes check switch functioning before putting the vehicle in service.
- It is advisable to install the switch in a position that can be easily reached by the operator, keeping path for cables as shorter as possible.
- For the model BDS250 rotate the switch clockwise to enable it.

~~NEWS~~

SPECIFICATIONS

MODEL	BDS150	BDS200 / BDS200S	BDS250
Current for 1 hour at 24V	150 A	200 A	250 A
Max. Current 5"	600 A	800 A	2500 A
Operating Temperature	from - 40 to + 80 °C	from - 40 to + 80 °C	from - 40 to + 80 °C
Contacts	Silver	Silver	Silver-plated Copper
Max. Voltage	48V	96V	96V
Blowout Magnetes	absent	absent / present	absent
Weight	150 g	270 g	650 g

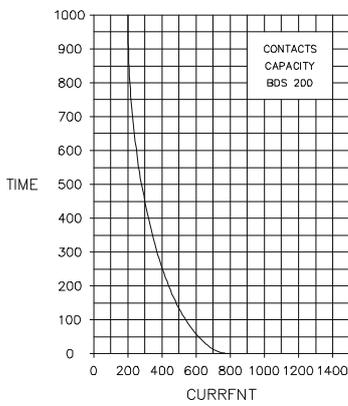
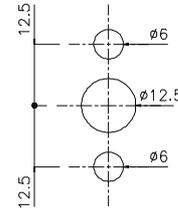
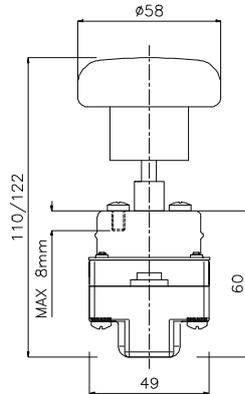
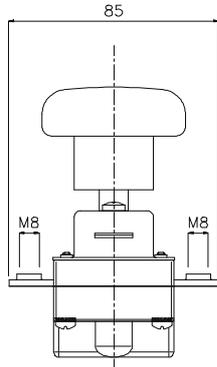
DIMENSIONS AND PERFORMANCE



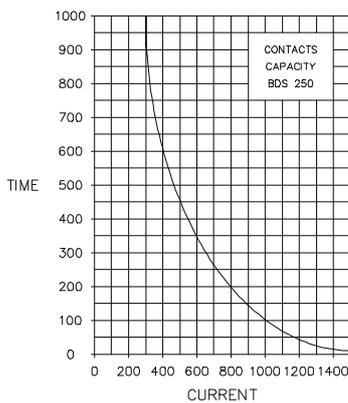
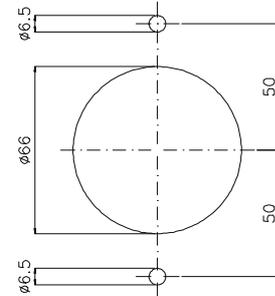
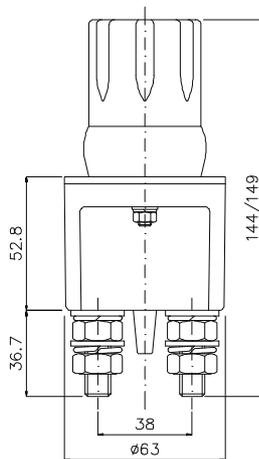
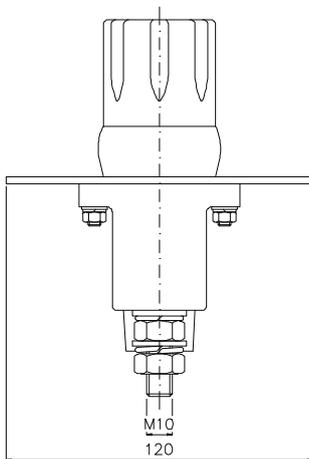
BDS150



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BDS200 / BDS200S



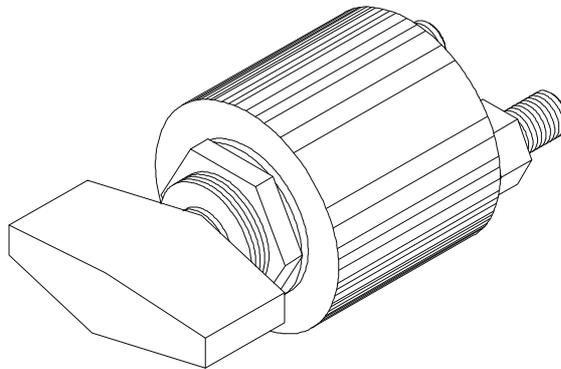
BDS250



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UNIPOLAR BATTERY DISCONNECTING KEYSWITCH



FEATURES

The battery disconnecting switch has been designed for applications to electric vehicles in order to disconnect battery in case of serious anomalies.

Moreover the switch must be pushed when maintenance operations on electric parts are carried out.

It guarantees a perfect insurance against thefts and fire risks for vehicles parked or waiting.

Switches have small dimensions, are easy to install and are able to disconnect at peak load; moreover the opening double contact guarantees a big capacity and prevents jamming.

ASSEMBLING AND USE

- Be sure that the switch is assembled in such a position that electric arcs do not damage electric wires or other parts.

- Be sure that the cap is perfectly tightened.

- Never use as switch for vehicle running.

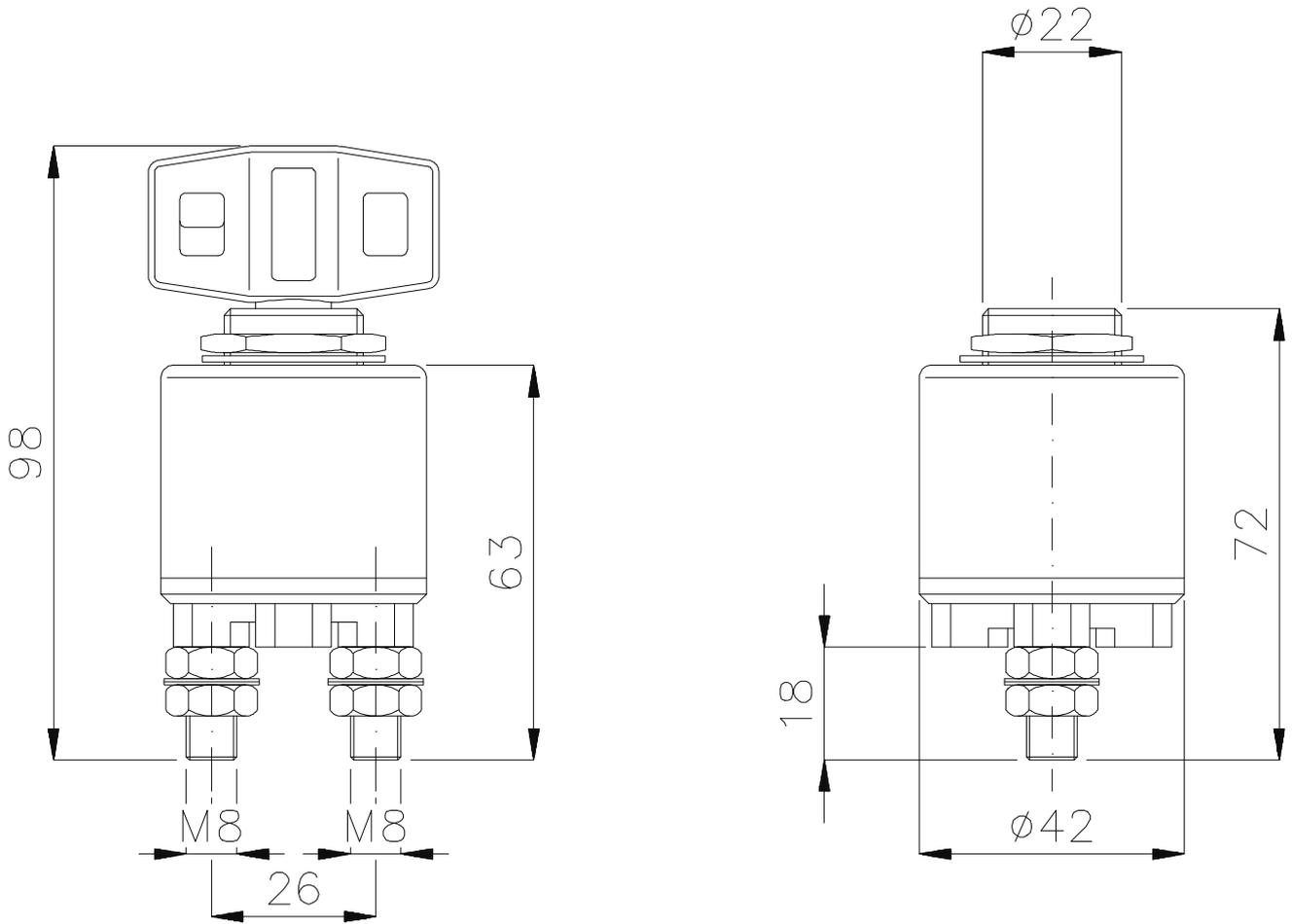
- No special maintenance is required but for safety purposes check switch functioning before starting the vehicle.

- It is advisable to assemble the switch in a position that can be easily reached by the operator, keeping path for cables as shorter as possible.

- Rotate the key in order to rapidly disconnect the switch.

~~NEWS~~

DIMENSIONS



All dimensions are in mm.

SPECIFICATIONS

Current for 1 Hour at 24V	100 A
Max Current for 5"	300 A
Operating Temperature	from -40 to +80 °C
Weight	150 g



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ELECTRIC HEATER



The electric heater has been designed for heating cabins on battery powered vehicles.

The system is environment-friendly thanks to the total absence of polluting fuels and to the high efficiency.

Supplied in a solid, plastic housing fitted on a metal surface the equipment is complete with a fan to guarantee an optimal air flow through two 60mm diameter output gates.

The system uses PTC resistors.

The heater is electrically safe and high performing. A big section supply connector with rapid connection, a protection fuse and a main contactor make this device extremely reliable.

The equipment has been designed and made in compliance with EC safety regulations.

For an easy installation, a special output connector is used for the connection with the thermostat. The thermostat supplied with the equipment is provided with a switch to start the equipment with a signalling LED, a holding temperature selector and a connection cable.

On request other accessories are available, like output gates to canalise the air flow, 60mm diameter flexible hose and output terminals with adjustable direction and flow.

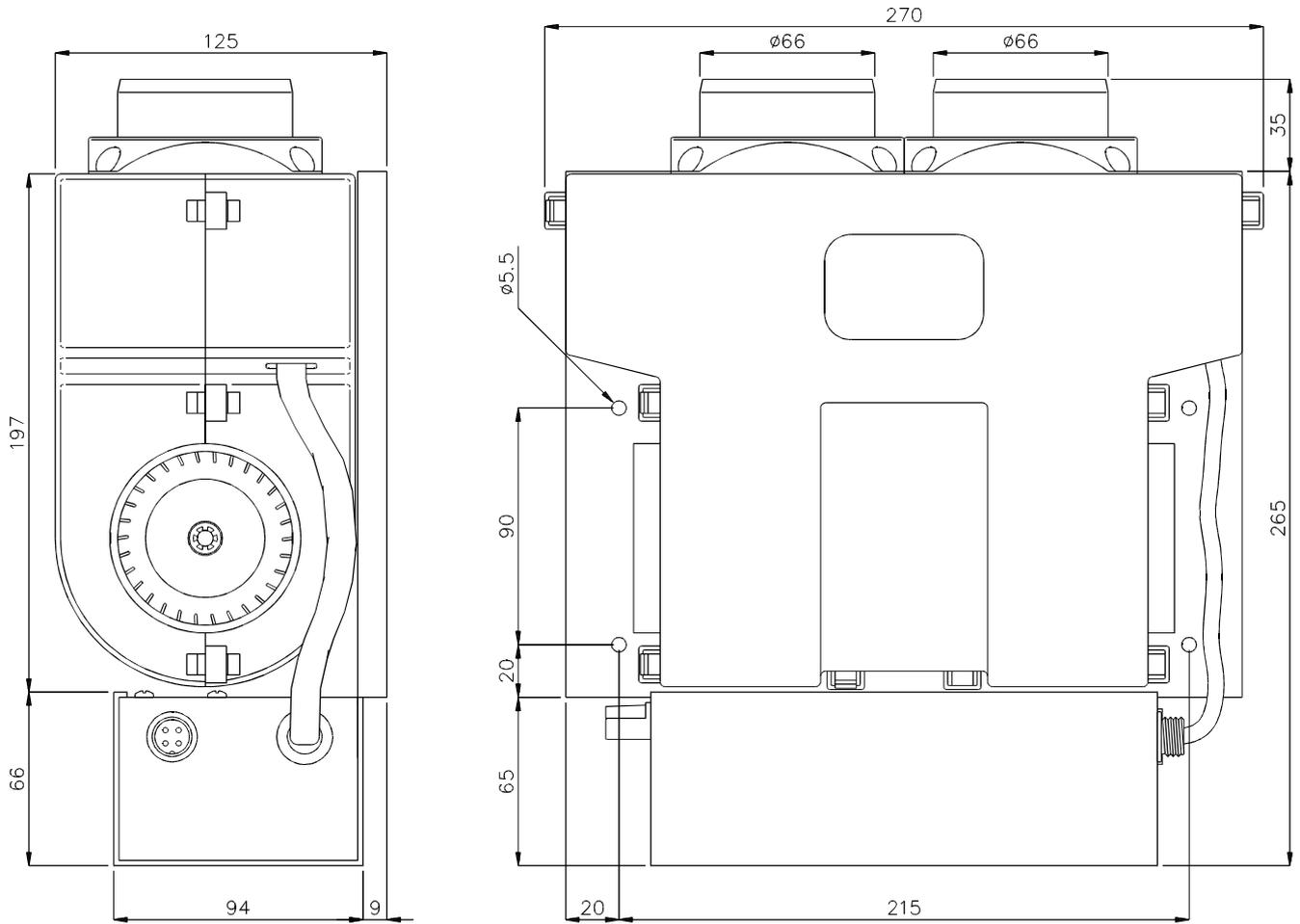
Models available:

Voltage 24-48-72-80-96V

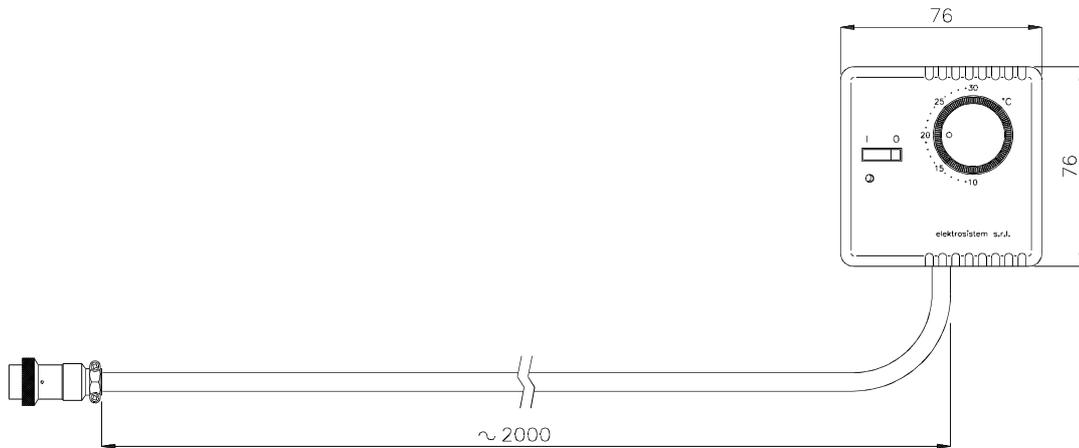
Power 1200W

~~NEWS~~

DIMENSIONS

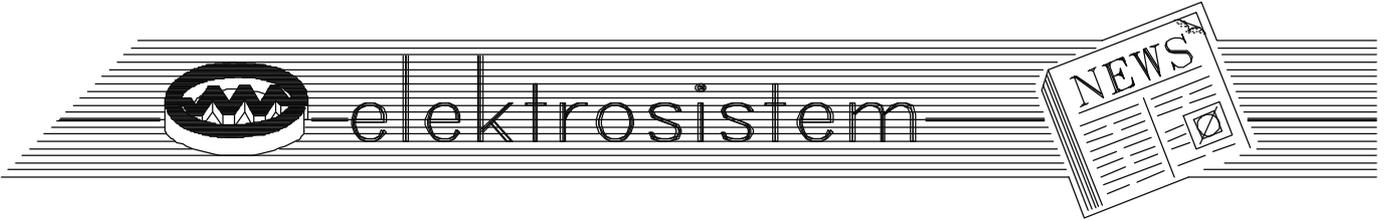


The heater is supplied with a thermostat that connected to the equipment controls its operation, enabling to keep the desired temperature.

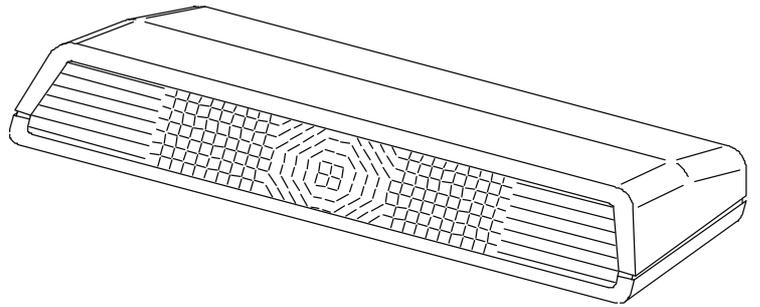


N.B. dimensions in mm.

Technical specifications subject to changes without notice



REAR LIGHT WITH ACOUSTIC SIGNALLER MODEL



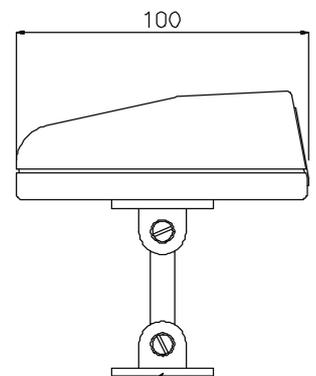
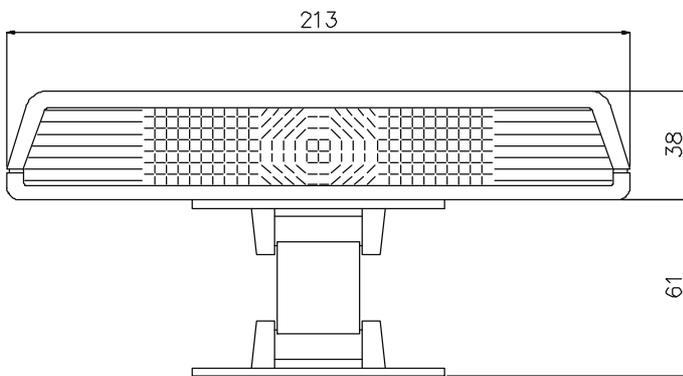
The flickering multivoltage light with built-in acoustic signaller has been designed to increase operators safety during vehicles reverse running.

The light and/or acoustic signaller are used to warn people around the vehicle of possible danger.

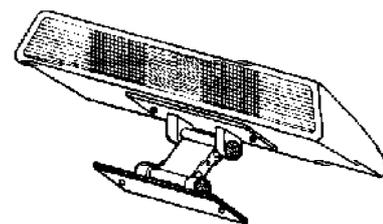
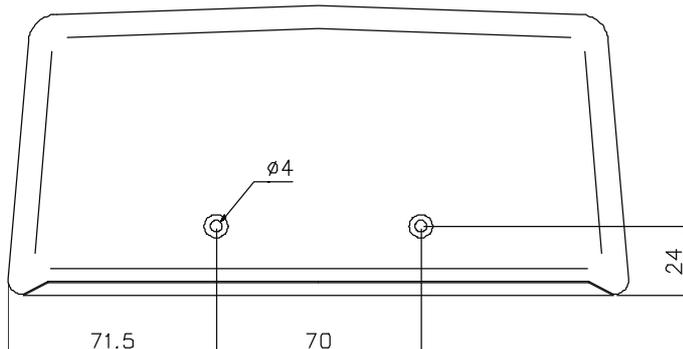
This part is included among the safety devices provided for by the law provision 626/94.

For specific assembling requirements, a supporting kit for the flickering multivoltage light is available (on request). This allows not only light lifting but also adjusting.

FMI DIMENSIONS



Supporting Kit on Request

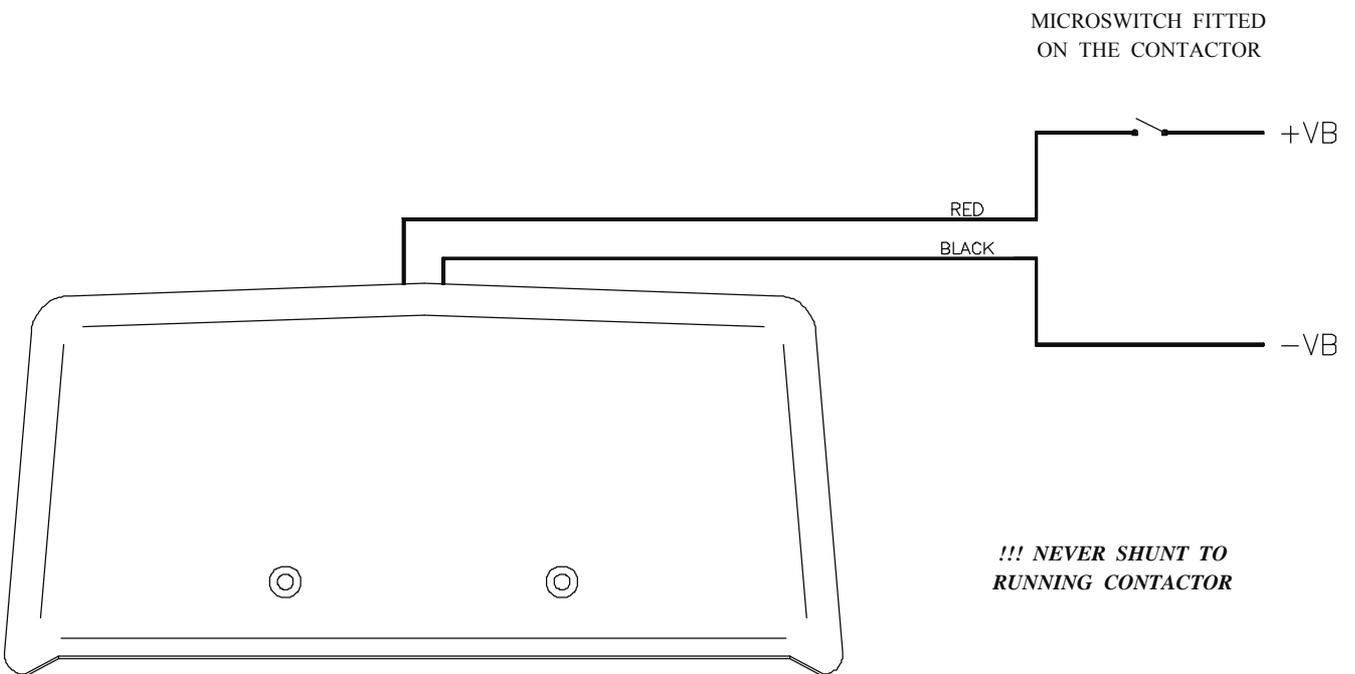


~~NEWS~~

FMI MODELS

MODEL	REF. NUMBER	RUNNING VOLTAGE	FEATURES
FMI-01	20.002550	12/120V Multivoltage	Flickering light with intermittent acoustic signaller
FMI-02	20.002551	12V	Fixed light with intermittent acoustic signaller
FMI-03	20.002552	24V	Fixed light with intermittent acoustic signaller
FMI-0	51.022581	/	Accessories for adjusting support

FMI CONNECTION





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HEADLIGHTS AND FLASH LIGHTS TYPE FLASH, STROBO AND ROTO

Today, handling technology is associated with a greater attention for users safety. In order to gear products to national and international standards manufacturers of lift trucks, transpallets, cranes, floor washing machines, sweepers and other vehicles operating in industrial and public areas such as stations, airports, harbours, etc. are now installing acoustic and visual signalling systems (flash lights, horns, alarms, etc.), that are generally quite inexpensive but add reliability to the product.

Elektrosistem, a company always interested in meeting customers' requirements, has designed a rotating headlight, a flash light with intensity 21-70W at 12/24/36 VDC and a multivoltage xenon flash light operating at 10/120 VDC.

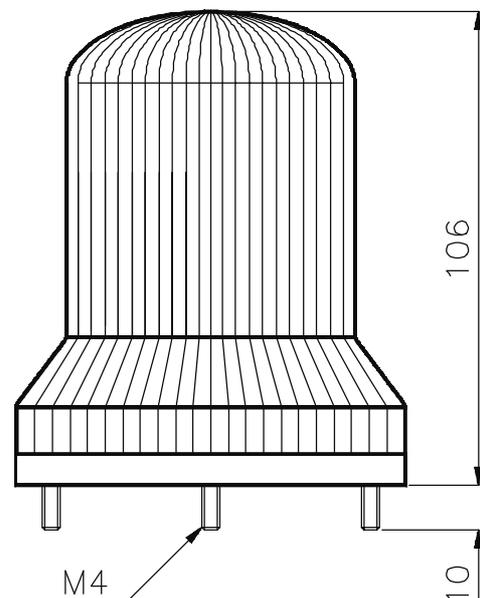
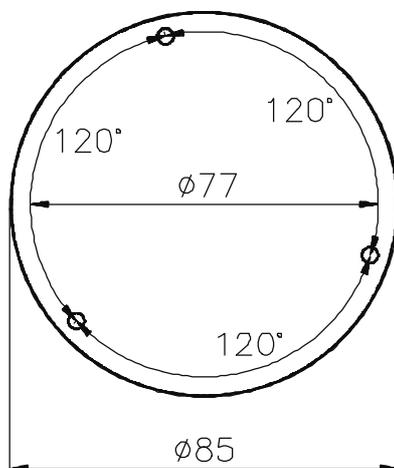
The rotating headlight can be supplied in a kit with an SMPS-09A power supply for voltages other than 12 and 24 VDC.

MAIN TECHNICAL FEATURES OF HEADLIGHTS WITH XENON LIGHTS (type STROBO)

- Multivoltage: 10 - 120V
- Xenon light
- Electrical input: $\pm 2.5W$
- Adjustable flashing frequency: 0.55 - 1.1Hz
- Protection IP 56
- Running temperature: $-30^{\circ}C$ $+40^{\circ}C$

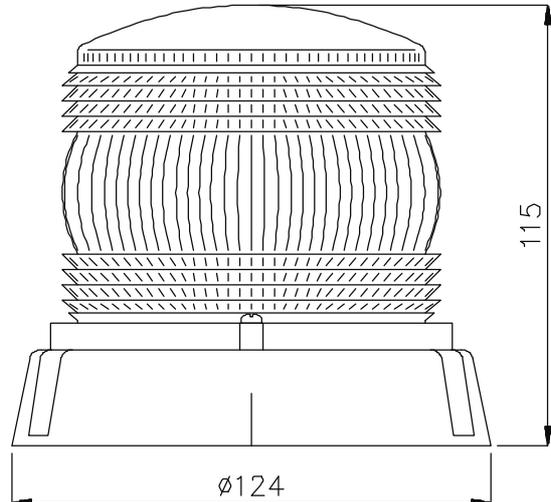
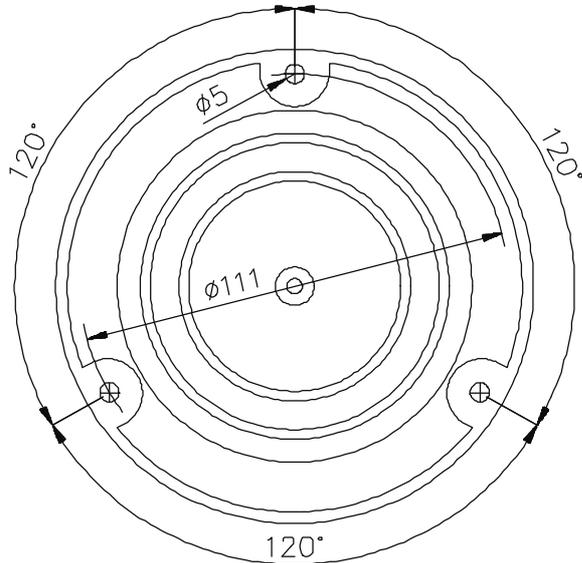
Made up of a moplen base and a metacrylate methyl cover.

FLASH-1 for voltages of 12V, 24V and 36V
STROBO-1 for voltages from 10V to 120V

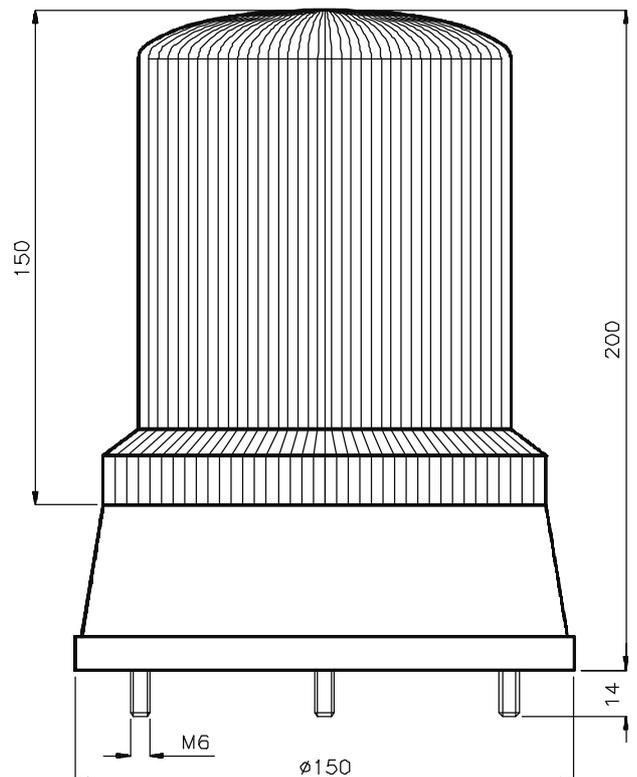
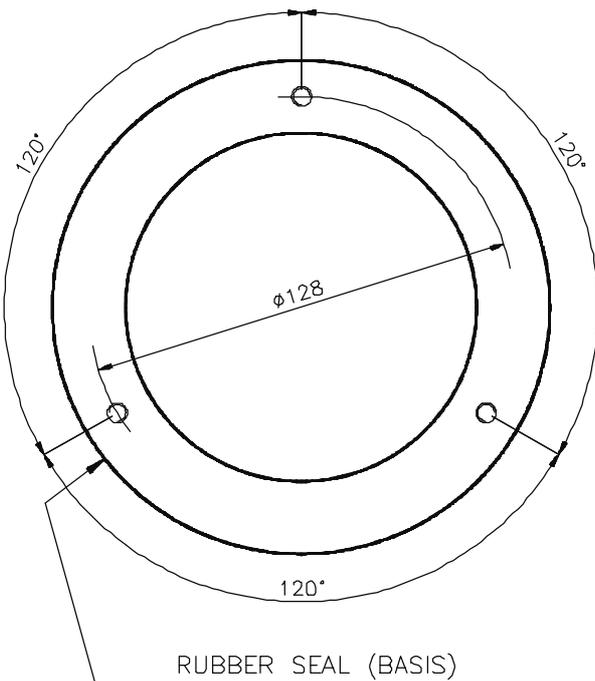


~~NEWS~~

STROBO-3 for voltages from 10V to 120V
FLASH-3 for voltages of 36V



ROTO-5 for voltages from 12V to 24V
ROTO-5 for voltages from 36V to 80V with SMPS-09A power supply
STROBO-5 for voltages from 10V to 120V

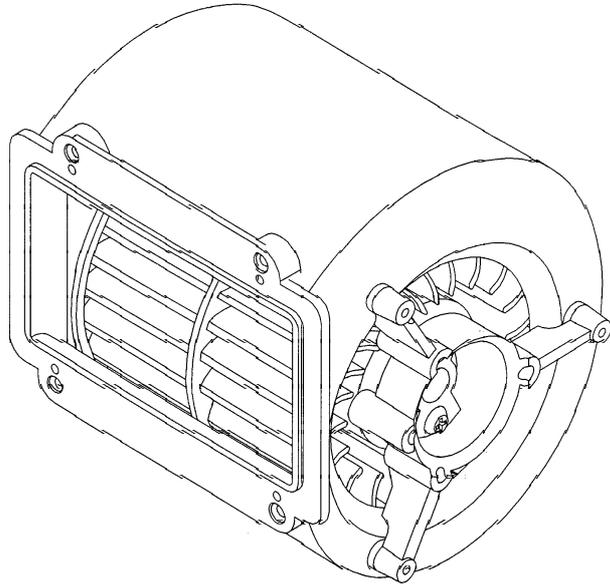




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MOTOR FAN 50W 24VDC



Continuous technology improvements and always more sophisticated systems for lift truck equipment have completely changed the space-dimensions relationship, resulting in the concentration of many apparatus in small spaces.

This trend has brought to the need for forced ventilation systems able to create the temperature conditions necessary for the good functioning of electronic control and drive systems.

stems.

In order to solve aeration problems, Elektrosistem has designed a low voltage tangential fan, that can even be supplied together with an SMPS-09A power supply for voltages other than 24V.

On request, the thermal switch necessary to make ventilation system enabling automatic can be supplied.

MOTOR FAN DIMENSIONS

