### ELECTRONIC CONTROL UNITS

<table>
<thead>
<tr>
<th>Section / Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCE TABLE</td>
<td>EC2</td>
</tr>
<tr>
<td>PWM DRIVERS</td>
<td>EC3</td>
</tr>
<tr>
<td>MACHINE MANAGEMENT SYSTEMS</td>
<td>EC19</td>
</tr>
<tr>
<td>GRAPHIC DISPLAY UNITS</td>
<td>EC33</td>
</tr>
<tr>
<td>ACCESSORIES</td>
<td>EC41</td>
</tr>
</tbody>
</table>

**WARNING:** the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
### WARNING:
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<table>
<thead>
<tr>
<th>Setting by Trimmers</th>
<th>Setting by PC</th>
<th>Setting by Switches</th>
<th>Connection for Display</th>
<th>CANbus Interface</th>
<th>RS485</th>
<th>RS232 (interface needed)</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Total Number of Outputs</strong></td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>8-12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **PWM Outputs** | 1 | (NOR simultaneous) | 2 | (max 3.5 A) | 4 | (optional max 5 A) |
| **Analog Outputs** | 6 (0-5 V) | 6 (0-5 V) | 1 (0-5 V) | 1 (0-5 V) |
| **High Side Power Outputs** | 11 (max 3.5 A) | 13-14 (max 1.5 A (max 2 simultaneous) | 20 (max 4 simultaneous) | 21 (max 4 simultaneous) |
| **Low Side Power Outputs** | 12 | 10 | 6-7 | 8 |
| **Signal Digital Outputs** | 16 | 10 | 10 | 4 |
| **Total Number of Inputs** | 1 | 188 | 8-10 | 15-19 |
| **Analog Inputs** | 1 | 186 | 8 | 11 |
| **Optoisolated Digital Inputs** | 2 | 2 | 2 | 4 |
| **Digital Inputs** | 6 | 6 | 6 | 4 |
| **Power Supply Range** | 8-50 V | 8-32 V | 9-30 V | 8-32 V |

<table>
<thead>
<tr>
<th>Tecnord P/N</th>
<th>PWM DRIVERS</th>
<th>MACHINE MANAGEMENT SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWM card 1 coil, 1 channel</td>
<td>EC-PWM-A1-MPC1-08-10</td>
<td>MMS 10 inputs, 12 outputs</td>
</tr>
<tr>
<td>PWM card 2 coils, 1 channel</td>
<td>EC-PWM-A2-MPC1-08-10</td>
<td>MMS 15 inputs, 18 outputs</td>
</tr>
<tr>
<td>PWM card 4 coils, 2 channels</td>
<td>EC-PWM-A4-MPC1-08-10</td>
<td>MMS 48 inputs, 48 outputs (coding card)</td>
</tr>
<tr>
<td>PWM card 8 coils, 4 channels</td>
<td>EC-PWM-A8-MPC1-08-10</td>
<td>MMS 62 inputs, 52 outputs (main unit)</td>
</tr>
<tr>
<td>PWM card 8 coils, 4 channels (programmable)</td>
<td>EC-PWM-A8-MPC1-08-02</td>
<td>MMS 15 inputs, 21 outputs (main unit)</td>
</tr>
</tbody>
</table>

**Tecnord**

4484 Boeing Drive Rockford, IL 61109 • USA • Phone +1 (815) 397-6626 • Fax +1 (815) 397-2526

**Delta Power Company**

4484 Boeing Drive Rockford, IL 61109 • USA • Phone +1 (815) 397-6626 • Fax +1 (815) 397-2526

mail: deltal@delta-power.com • [www.delta-power.com](http://www.delta-power.com)
## PWM DRIVERS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
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<tbody>
<tr>
<td>EC-PWM-A1-MPC1-P</td>
<td>1 PWM output for single solenoid valve wire connection</td>
<td>EC4</td>
</tr>
<tr>
<td>EC-PWM-A1-MPC1-D</td>
<td>1 PWM output for single solenoid valve DIN plug for coil mounting</td>
<td>EC6</td>
</tr>
<tr>
<td>EC-PWM-A1-MPC1-E</td>
<td>1 PWM output for 1 single solenoid valve male DIN plug connection</td>
<td>EC8</td>
</tr>
<tr>
<td>EC-PWM-A2-MPC1-*</td>
<td>1 PWM output for 1 dual solenoid valve wire connection</td>
<td>EC10</td>
</tr>
<tr>
<td>EC-PWM-P4-MPC2-H</td>
<td>2 PWM outputs for 2 dual solenoid valves programmable</td>
<td>EC12</td>
</tr>
<tr>
<td>EC-PWM-08-MPC4-H</td>
<td>4 PWM outputs for 4 dual solenoid valves fixed settings</td>
<td>EC14</td>
</tr>
<tr>
<td>EC-PWM-P8-MPC4-H</td>
<td>4 PWM outputs for 4 dual solenoid valves programmable</td>
<td>EC16</td>
</tr>
</tbody>
</table>
DESCRIPTION
Microprocessor-based PWM electronic driver for remote control of a single proportional solenoid valve.

OPERATION
The EC-PWM-A1-MPC1-P proportional valve driver receives a command signal from a potentiometer, PLC or other control systems, and supplies a solenoid with a PWM (Pulse Width Modulated) current proportional to the input signal. An auxiliary power supply (+5 V) is provided as a reference for the command signal. Adjustments of “Imin/Imax”, “Ramp time” and “Dither” can be carried out directly from a key-pad integrated on the front panel.

Mounting option: panel-mounting style with INPUT/OUTPUT multi-core sheated cable.

FEATURES
- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Power supply line is protected against reversed polarity and load dump.
- Input is protected against short circuits to GND and power supply.
- Output is protected against short circuits, over-current and over-temperature.
- The EC-PWM-A1-MPC1 is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>8.5÷30 VDC</td>
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<tr>
<td>Max current consumption</td>
<td>100 mA (no load applied)</td>
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<tr>
<td>Operating temperature</td>
<td>-25°C / +85°C</td>
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<tr>
<td>Input resistance 0÷5 V voltage input</td>
<td>560 KOhms</td>
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<tr>
<td>0÷10 V voltage input</td>
<td>1 MOhm</td>
</tr>
<tr>
<td>0÷20mA current input</td>
<td>250 Ohms</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 67</td>
</tr>
<tr>
<td>Analog input signals available</td>
<td>0÷5 V</td>
</tr>
<tr>
<td></td>
<td>0÷10 V</td>
</tr>
<tr>
<td></td>
<td>0÷20 mA</td>
</tr>
<tr>
<td>Typical ctrl pot resistance</td>
<td>2÷47 kΩ</td>
</tr>
<tr>
<td>Current output range (PWM)</td>
<td>100÷3000 mA</td>
</tr>
<tr>
<td>PWM dither frequency</td>
<td>55÷200 Hz (adjustable)</td>
</tr>
<tr>
<td>Ramp time</td>
<td>0.05÷5 s (adjustable)</td>
</tr>
<tr>
<td>Max. current from auxiliary +5 V</td>
<td>15 mA</td>
</tr>
</tbody>
</table>

APPLICATIONS
Primary applications are the control of proportional pressure reducing valves and proportional flow regulators to attain smooth acceleration/deceleration and fine-metering control of electro-hydraulic functions.

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
**Wiring Colours**

Blue  +Battery  
Brown  -Battery (GND)  
Red    Command signal supply (+5 V)  
Yellow Command signal in  
Gray   Command signal GND  
White  Proportional coil output  
Green  Proportional coil current feedback line  
Pink   Spare / Not used  

**Note**
A 5A fuse must be inserted on the BLUE wire connecting the PWM driver to the power source.

**ADJUSTMENTS**

The following adjustments can be made directly from the front key-pad by selecting the 3-pushpins in appropriate combinations:
- Imin (minimum output current)
- Imax (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

**APPLICATION EXAMPLE**

Remote operation of a proportional flow control valve from single axis/unidirectional control lever incorporating a rotary potentiometer and a center/power-off switch for the energization of an auxiliary solenoid-operated dump valve.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.0409.045</td>
<td>0-5 V</td>
</tr>
<tr>
<td>23.0409.087</td>
<td>0-10 V</td>
</tr>
<tr>
<td>23.0409.136</td>
<td>0-20 mA</td>
</tr>
</tbody>
</table>

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DESCRIPTION

Microprocessor-based PWM electronic driver for remote control of a single proportional solenoid valve.

OPERATION

The EC-PWM-A1-MPC1-D proportional valve driver receives a command signal from a potentiometer, PLC or other control systems, and supplies a solenoid with a PWM (Pulse Width Modulated) current proportional to the input signal. An auxiliary power supply (+5 V) is provided as a reference for the command signal. Adjustments of “Imin/Imax”, “Ramp time” and “Dither” can be carried out directly from a key-pad integrated on the front panel.

Mounting option: female DIN 43650 socket on valve’s side and sheated exit cable to connect to power source and remote control devices.

FEATURES

- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Power supply line is protected against reversed polarity and load dump.
- Input is protected against short circuits to GND and power supply.
- Output is protected against short circuits, over-current and over-temperature.
- The EC-PWM-A1-MPC1 is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>8.5÷30 VDC</td>
</tr>
<tr>
<td>Max current consumption</td>
<td>100 mA (no load applied)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25°C / +85°C</td>
</tr>
<tr>
<td>Input resistance 0÷5 V input</td>
<td>560 KOhs</td>
</tr>
<tr>
<td>Input resistance 0÷10 V input</td>
<td>1 MOhm</td>
</tr>
<tr>
<td>Input resistance 0÷20 mA input</td>
<td>250 Ohms</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 67</td>
</tr>
<tr>
<td>Analog input signals available</td>
<td>0÷5 V, 0÷10 V, 0÷20 mA</td>
</tr>
<tr>
<td>Typical ctrl pot resistance</td>
<td>2÷47 kΩ</td>
</tr>
<tr>
<td>Current output range (PWM)</td>
<td>100÷3000 mA</td>
</tr>
<tr>
<td>PWM dither frequency</td>
<td>55÷200 Hz (adjustable)</td>
</tr>
<tr>
<td>Ramp time</td>
<td>0.05÷5 s (adjustable)</td>
</tr>
<tr>
<td>Max. current from auxiliary +5 V</td>
<td>15 mA</td>
</tr>
</tbody>
</table>

APPLICATIONS

Primary applications are the control of proportional pressure reducing valves and proportional flow regulators to attain smooth acceleration/deceleration and fine-metering control of electro-hydraulic functions.
**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

**Power supply wiring colours**
- Blue (+) Positive from power source
- Yellow/Green (-) Negative from (GND)

**Remote potentiometer wiring colours**
- Black Command signal supply (+5 V)
- Brown Command signal in

**Proportional valve connector pins**
- 1 Proportional coil output
- 2 Proportional coil current feedback line

**Note**
A 5A fuse must be inserted on the BLUE wire connecting the PWM driver to the power source.

**ADJUSTMENTS**

The following adjustments can be made directly from the front key-pad by selecting the 3-pushpins in appropriate combinations:
- **Imin** (minimum output current)
- **Imax** (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

**APPLICATION EXAMPLE**

Remote operation of a proportional flow control valve from single axis/unidirectional control lever incorporating a rotary potentiometer.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
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<tr>
<td>23.0409.046</td>
<td>0-5 V</td>
</tr>
<tr>
<td>23.0409.065</td>
<td>0-10 V</td>
</tr>
<tr>
<td>23.0409.077</td>
<td>0-20 mA</td>
</tr>
</tbody>
</table>

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DESCRIPTION
Microprocessor-based PWM electronic driver for remote control of a single proportional solenoid valve.

OPERATION
The EC-PWM-A1-MPC1-E proportional valve driver receives a command signal from a potentiometer, PLC or other control systems, and supplies a solenoid with a PWM (Pulse Width Modulated) current proportional to the input signal. An auxiliary power supply (+5 V) is provided as a reference for the command signal. Adjustments of “Imin/Imax”, “Ramp time” and “Dither” can be carried out directly from a key-pad integrated on the front panel.

Mounting option: female DIN 43650 socket on valve’s side and male DIN 43650 plug to connect to power source and remote control devices.

FEATURES
- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Power supply line is protected against reversed polarity and load dump.
- Input is protected against short circuits to GND and power supply.
- Output is protected against short circuits, over-current and over-temperature.
- The EC-PWM-A1-MPC1 is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>8.5÷30 VDC</td>
</tr>
<tr>
<td>Max current consumption</td>
<td>100 mA (no load applied)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25°C / +85°C</td>
</tr>
<tr>
<td>Input resistance 0÷5 V voltage input</td>
<td>560 KOhms</td>
</tr>
<tr>
<td>Input resistance 0÷10 V voltage input</td>
<td>1 MOhm</td>
</tr>
<tr>
<td>Input resistance 0÷20 mA current input</td>
<td>250 Ohms</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 67</td>
</tr>
<tr>
<td>Analog input signals available</td>
<td>0÷5 V</td>
</tr>
<tr>
<td>Typical ctrl pot resistance</td>
<td>2÷47 kΩ</td>
</tr>
<tr>
<td>Current output range (PWM)</td>
<td>100÷3000 mA</td>
</tr>
<tr>
<td>PWM dither frequency</td>
<td>55÷200 Hz (adjustable)</td>
</tr>
<tr>
<td>Ramp time</td>
<td>0.05÷5 s (adjustable)</td>
</tr>
<tr>
<td>Max. current from auxiliary +5 V</td>
<td>15 mA</td>
</tr>
</tbody>
</table>

APPLICATIONS
Primary applications are the control of proportional pressure reducing valves and proportional flow regulators to attain smooth acceleration/deceleration and fine-metering control of electro-hydraulic functions.
ADJUSTMENTS

The following adjustments can be made directly from the front key-pad by selecting the 3-pushpins in appropriate combinations:

- $I_{\text{min}}$ (minimum output current)
- $I_{\text{max}}$ (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

APPLICATION EXAMPLE

Remote operation of a proportional flow control valve from single axis/unidirectional control lever incorporating a rotary potentiometer.

ORDERING INFORMATION

<table>
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<th>Part numbers</th>
<th>Version</th>
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<td>23.0409.089</td>
<td>0-5 V</td>
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<tr>
<td>23.0409.047</td>
<td>0-10 V</td>
</tr>
<tr>
<td>23.0409.137</td>
<td>0-20 mA</td>
</tr>
</tbody>
</table>

EC-PWM-A1-MPC1-E

$A = \text{Adjustable}$

$E = \text{DIN 43650 plug connector}$

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EC-PWM-A2-MPC1-*  PWM DRIVER

DESCRIPTION
Microprocessor-based PWM electronic driver for remote control of a dual-coil proportional solenoid valve.

OPERATION
The EC-PWM-A2-MPC1 proportional valve driver supplies a double solenoid with a PWM (Pulse Width Modulated) current proportional to the input signal from a potentiometer, PLC or other control systems.

Proportional valve A is controlled with an input command signal varying from 2.5 to 4.5 V. Proportional valve B is controlled with an input command signal varying from 2.5 to 0.5 V. An auxiliary on-off type solenoid can be energised anytime the input signal goes out of the 2.25-2.75 V range.

FEATURES
- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Supply line is protected against reversed polarity.
- Input is protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- The EC-PWM-A2 circuit is potted inside a plastic enclosure suitable for panel mounting by means of 2 set screws.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Operating voltage</td>
<td>8÷32 VDC</td>
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<tr>
<td>Max current consumption</td>
<td>100 mA (no load applied)</td>
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<td>Operating temperature</td>
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<td>Degree of protection</td>
<td>IP 68</td>
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<tr>
<td>Input impedance</td>
<td>40 kΩ</td>
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<tr>
<td>Analog input signals</td>
<td>0.5 - 2.5 - 4.5 VDC</td>
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<tr>
<td>Typical ctrl pot resistance</td>
<td>2÷10 kΩ</td>
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<td>Current output range (PWM)</td>
<td>100÷1500 mA</td>
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<td>Current on-off output</td>
<td>max 1800 mA</td>
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<td>PWM dither frequency</td>
<td>100 Hz</td>
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<tr>
<td>Resolution</td>
<td>10 bits</td>
</tr>
<tr>
<td>Deutsch connector (male contacts)</td>
<td>DT04-8P</td>
</tr>
</tbody>
</table>

APPLICATIONS
- 12 VDC and 24 VDC systems.
- Remote control of proportional valves.
- Field-adjustable applications.
- Control of a proportional bidirectional valve with a venting valve.

DIMENSIONS

Cable length: 150 mm

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**H VERSION - PINOUT**

1. +V (POWER SUPPLY)
2. -V (POWER SUPPLY)
3. PWM A (+)
4. PWM B (+)
5. PWM A/B (COMMON)
6. COMMAND (0-5 V)
7. VENTING VALVE
8. +5 V AUX

Deutsch connector
8 ways receptacle DT04-8P

**C VERSION - WIRING DIAGRAM**

Circuit board soldering side view

- Red (+V POWER SUPPLY)
- Black (GND)
- Pink (PWM_COM)
- Grey (PWM_A)
- Orange (PWM_B)
- Green (VENTING)
- Black (+5 V)
- Purple (COMMAND SIGNAL)

**APPLICATION EXAMPLE**

- (1) Red
- (2) Black
- (5) Pink
- (3) Gray
- (4) Orange
- (7) Green
- (6) Purple
- (8) Orange

Proportional control of a dual coil valve from a bidirectional lever, joystick or roller.

**ADJUSTMENTS**

Two rotary trimmers are located on the rear potted surface to provide the following field adjustments:
- I_min (minimum output current)
- I_max (maximum output current)

Factory Setting

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
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</tr>
<tr>
<td>23.0409.109</td>
<td>C</td>
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</table>

**EC-PWM-A2-MPC1.**

A = trimmer Adjustable version
H = potted plastic Housing
C = Circuit board only

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**EC-PWM-P4-MPC2-H**  PWM DRIVER

**DESCRIPTION**

Microprocessor-based PWM driver for remote control of 2 dual-coil proportional solenoid valves.

**OPERATION**

The EC-PWM-P4-MPC2-H proportional valve driver supplies up to two dual-coil proportional valves with PWM (Pulse Width Modulated) current proportional to input signals coming from potentiometers, PLC or other control systems. The control characteristics (Imin/Imax, ramps, dither) are configurable via PC connected with a RS232 serial line to a configuration kit and PC interface of Tecnord supply.

**FEATURES**

- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Supply line is protected against reversed polarity and load dump.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- The EC-PWM-P4-MPC2-H is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

**SPECIFICATIONS**

- Operating voltage: 9÷30 VDC
- Max current consumption: 100 mA (no load applied)
- Operating temperature: -25°C / +85°C
- Degree of protection: IP 67
- Input impedance: 100 kΩ
- Analog inputs: 4 x 0-5 V
- Typical ctrl pot resistance: 1÷10 kΩ
- Resolution: 10 bit
- PWM outputs channels: 2 x dual-coil proportional valves
- Current output range (PWM): 100÷1500 mA (3 A version available)
- PWM dither frequency: 75÷250 Hz (adjustable)
- On-off digital output: 1 (1500 mA)

**APPLICATIONS**

- Specifically designed for applications requiring accurate adjustments and calibrations.
- 12 VDC and 24 VDC systems.
- Remote control of non-feedback proportional valves.
- Control of a proportional bidirectional valve with a venting valve.
**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

**ADJUSTMENTS**
Adjustments can be effected via RS232 serial line to modify the following work parameters:
- I\text{min} (minimum output current)
- I\text{max} (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

 Calibration tool ordering code: 20.1001.026/A
 RS232 cable adapter for PC connection including calibration software on CD (see page EC44-45).

**APPLICATION EXAMPLE**
Proportional regulation of 2 dual-coil valves with 1 bidirectional joystick.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.0409.237</td>
<td>1.5 A</td>
</tr>
<tr>
<td>23.0409.238</td>
<td>3 A</td>
</tr>
</tbody>
</table>

**WARNING:** The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.

**EC-PWM-P4-MPC2-H**  
P = Programmable  
H = potted plastic Housing
DESCRIPTION
Microprocessor-based PWM driver for remote control of 4 dual-coil proportional solenoid valves.

OPERATION
The EC-PWM-08-MPC4 proportional valve driver supplies up to four dual-coil proportional solenoid valves with PWM (Pulse Width Modulated) current proportional to the input signals coming from potentiometers, PLC or other control systems. PWM currents are factory pre-set and cannot be adjusted.

FEATURES
- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Supply line is protected against reversed polarity and load dump.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- The EC-PWM-08-MPC4-H is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS
- Operating voltage: 9÷30 VDC
- Max current consumption: 100 mA (no load applied)
- Operating temperature: -40°C / +100°C
- Degree of protection: IP 67
- Input impedance: 100 kΩ
- Analog inputs: 6 x 0-5 V
- Typical ctrl pot resistance: 1÷10 kΩ
- Digital inputs: 2 x PNP (Active High)
- Resolution: 10 bit
- PWM outputs channels: 4 x dual-coil proportional valves
- Current output range (PWM): 100÷1500 mA
- PWM dither frequency: 75÷250 Hz (factory pre-set, standard 100 Hz)

APPLICATIONS
- Specifically designed for applications with factory-set working parameters and requiring no field-adjustments.
- 12 VDC and 24 VDC systems.
- Remote control of proportional valves.
- Control of a 4 functions proportional bidirectional system.
WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.

**EC-PWM-08-MPC4-H**  
**PWM DRIVER**

**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

Connector type: framatome SICMA2

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EV4A PROP. COIL OUTPUT FEEDBACK (•)</td>
<td>+V (POWER SUPPLY)</td>
<td>-V (POWER SUPPLY - GND)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>EV4B PROP. COIL OUTPUT FEEDBACK (•)</td>
<td>ANALOG INPUT - SPARE</td>
<td>+5 V DC EXTERNAL SUPPLY VOLTAGE</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EV3A PROP. COIL OUTPUT FEEDBACK (•)</td>
<td>ANALOG INPUT - SPARE</td>
<td>DIGITAL INPUT - SPARE</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>ANALOG INPUT FOR FUNCTION 4 (TO DRIVE EV4A/B)</td>
<td>ANALOG INPUT - SPARE</td>
<td>DIGITAL INPUT - SPARE</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>ANALOG INPUT FOR FUNCTION 3 (TO DRIVE EV3A/B)</td>
<td>ANALOG INPUT FOR FUNCTION 2 (TO DRIVE EV2A/B)</td>
<td>EV1A PROP. COIL OUTPUT FEEDBACK (•)</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>ANALOG INPUT FOR FUNCTION 1 (TO DRIVE EV1A/B)</td>
<td>COMMON COMMAND FOR FOR EV2A/B (+)</td>
<td>EV1B PROP. COIL OUTPUT FEEDBACK (•)</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>COMMON COMMAND FOR EV1A/B (+)</td>
<td>COMMON COMMAND FOR EV3A/B (+)</td>
<td>COMMON COMMAND FOR EV4A/B (+)</td>
</tr>
</tbody>
</table>

**ADJUSTMENTS**

Factory pre-set for:
- \( I_{\text{min}} \) (minimum output current)
- \( I_{\text{max}} \) (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

Factory pre-set values for the standard version p/n 23.0409.170:
- \( I_{\text{min}} = 100 \, \text{mA} \)
- \( I_{\text{max}} = 1500 \, \text{mA} \)
- Ramp-up/down time = 0 sec
- Dither frequency = 100 Hz

**APPLICATION EXAMPLE**

Proportional regulation of 4 dual-coil valves with 4 bidirectional control levers.

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.0409.170</td>
<td>1.5 A</td>
</tr>
</tbody>
</table>

0 = factory pre-set  
H = potted plastic Housing
**EC-PWM-P8-MPC4-H**  PWM DRIVER

**DESCRIPTION**

Microprocessor-based PWM driver for remote control of 4 dual-coil proportional solenoid valves.

**OPERATION**

The EC-PWM-P8-MPC4 proportional valve driver supplies up to four dual-coil proportional solenoid valves with PWM (Pulse Width Modulated) current proportional to the input signals coming from potentiometers, PLC or other control systems. The control characteristics (Imin/Imax, ramps, dither) are configurable via PC connected with a RS232 serial line to a configuration kit and PC interface of Tecnord supply.

**FEATURES**

- The current in the solenoid is independent from any change in the coil resistance or in the supply voltage.
- The inherent superimposed dither frequency helps to overcome friction and stiction effects in the controlled device.
- Supply line is protected against reversed polarity and load dump.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- The EC-PWM-P8-MPC4-H is completely potted.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

**SPECIFICATIONS**

- **Operating voltage:** 9÷30 VDC
- **Max current consumption:** 100 mA (no load applied)
- **Operating temperature:** -25°C / +85°C
- **Degree of protection:** IP 67
- **Input impedance:** 100 kΩ
- **Typical ctrl pot resistance:** 1÷10 kΩ
- **Analog inputs:** 8 x 0-5 V
- **Digital inputs:** analog inputs can be used as digital
- **Resolution:** 10 bit
- **PWM outputs channels:** 4 x dual-coil proportional valves
- **Current output range (PWM):** 100÷1500 mA (3 A version available)
- **PWM dither frequency:** 75÷250 Hz (adjustable)

**APPLICATIONS**

- Specifically designed for applications requiring accurate adjustments and calibrations.
- 12 VDC and 24 VDC systems.
- Remote control of non-feedback proportional valves.
- Control of up to 4 proportional bidirectional valves.

**DIMENSIONS**

- **Harness**
- **Framatome - Sicma2 24-PIN connector**
- **AMP Superseal 3 & 2 Pin connectors**
- **EC-PWM-P8-MPC4-H**

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**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

**Connector type: Framatome SICMA2**

A
1. EV4A Prop. coil output (+)
2. EV4B Prop. coil output (+)
3. EV3A Prop. coil output (+)
4. EV3B Prop. coil output (+)
5. Analog input for function 4 (to drive EV4A/B)
6. Analog input for function 3 (to drive EV3A/B)
7. Analog input for function 1 (to drive EV1A/B)
8. Feedback for EV1A/B

**B**
1. +V (Power supply)
2. NOT CONNECTED
3. Analog input - spare
4. Analog input for function 2 (to drive EV2A/B)
5. Analog input - spare
6. Feedback for EV2A/B
7. Feedback for EV4A/B
8. Feedback for EV3A/B

**C**
1. -V (Power supply - GND)
2. +5 VDC external supply voltage
3. Analog input - spare
4. Analog input - spare
5. EV1A Prop. coil output (+)
6. EV1B Prop. coil output (+)
7. EV2A Prop. coil output (+)
8. EV2B Prop. coil output (+)

**ADJUSTMENTS**

Adjustments can be effected via RS232 serial line to modify the following work parameters:
- Imin (minimum output current)
- Imax (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

Calibration tool ordering code: 20.1001.026/A
RS232 cable adapter for PC connection including calibration software on CD (see page EC44-45).

Note: USB/RS232 interface available on request.

**APPLICATION EXAMPLE**

Proportional regulation of 4 dual-coil valves with 2 bidirectional joysticks.

**ORDERING INFORMATION**

**EC-PWM-P8-MPC4-H**

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Version</th>
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<tbody>
<tr>
<td>23.0409.081</td>
<td>1.5 A</td>
</tr>
<tr>
<td>23.0409.071</td>
<td>3 A</td>
</tr>
</tbody>
</table>

P = Programmable
H = potted plastic Housing

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WARNING: The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
### MACHINE MANAGEMENT SYSTEMS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-MMS-1012-H</td>
<td>10 inputs, 12 outputs meter-in systems controller</td>
<td>EC20</td>
</tr>
<tr>
<td>EC-MMS-2218-H</td>
<td>22 inputs, 18 outputs RS232 / RS 485 interface</td>
<td>EC22</td>
</tr>
<tr>
<td>EC-MMS-1521-H</td>
<td>15 inputs, 21 outputs CANbus interface</td>
<td>EC24</td>
</tr>
<tr>
<td>EC-MMS-4820-H</td>
<td>48 inputs, 20 outputs RS 485 / CANbus interface</td>
<td>EC26</td>
</tr>
<tr>
<td>EC-MMS-0713-H</td>
<td>7 inputs, 13 outputs Deutsch connection / RS 485 interface</td>
<td>EC28</td>
</tr>
<tr>
<td>EC-MMS-6252-H</td>
<td>62 inputs, 52 output RS485 / CANbus interface</td>
<td>EC30</td>
</tr>
</tbody>
</table>
EC-MMS-1012-H  MACHINE MANAGEMENT SYSTEM

DESCRIPTION

Digital MMS (Machine Management System) with built-in advanced safety and fault detection features for integrated control of mobile equipment functions.

OPERATION

10 inputs and 12 outputs are managed by this small-size unit. PWM current outputs are field-adjustable and their setting is stored in an EEPROM memory. Parameters can be loaded via software from a standard PC connected with a RS232 serial line. It can be used as a stand-alone controller for both meter-in systems (up to 5 functions) and bidirectional proportional systems (up to 4 functions). Additional output for a safety venting valve is available.

FEATURES

- Supply line is protected against reversed polarity and overvoltage.
- Inputs are protected against short circuits to GND and power supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- 3-wires RS232 serial interface.
- Auxiliary +5 V supply for control devices (e.g. potentiometers).
- Performance level capability according to ISO 13849, due to high reliability of components and embedded diagnostics.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS

- Operating voltage: 9÷30 VDC
- Max current consumption: 100 mA (no load applied)
- Operating temperature: -25°C / +85°C
- Degree of protection: IP 67
- Input impedance: 100 kΩ
- Analog inputs (10 bits): 8 (0-5 V)
- Typical ctrl pot resistance: 1÷10 kΩ
- Digital inputs: 2
- High side power outputs: 12 (3.5 A max)
- Inputs for current feedback: 4
- Current output range (PWM): 100÷1500 mA
- PWM dither frequency: 60÷200 Hz

APPLICATIONS

- 12 VDC and 24 VDC systems.
- Remote control of non-feedback proportional and on-off valves.
- Specifically designed for applications requiring accurate adjustments and calibrations.
- Control of up to 4 proportional bidirectional valves plus a venting valve and additional 3 auxiliary outputs.
- Control of up to 5 functions in meter-in configuration (10 on-off valves plus 1 proportional valve and 1 venting valve).

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
ADJUSTMENTS

Adjustments can be effected via RS232 serial line to modify the following work parameters:
- Imin (minimum output current)
- Imax (maximum output current)
- Ramp-up time
- Ramp-down time
- Dither frequency

Calibration tool ordering code: 20.1001.026/A
RS232 cable adapter for PC connection including calibration software on CD (see page EC44-45).

APPLICATION EXAMPLE

Note: USB/RS232 interface available on request.

ORDERING INFORMATION

EC-MMS-1012-H

1012 = 10 inputs - 12 outputs
H = potted plastic
Housing for panel mounting

Part number (Std Version)
23.0409.177
**DESCRIPTION**

Digital MMS (Machine Management System) with built-in advanced safety and fault detection features for integrated control of Mobile Equipment functions. CANbus capability make it suitable for high-end network systems.

**OPERATION**

22 inputs and 18 outputs are managed by this small-size unit. Analog outputs are field-adjustable and their setting is stored in an EEPROM memory and can be loaded via software from vehicle’s controller through CANbus or from a standard PC connected through an RS232 serial line. It can be used as a stand-alone controller or in conjunction with other MMS electronic units like Tecnord’s Mod. MMS-4820.

**FEATURES**

- Power Supply line is protected against reversed polarity and overvoltage.
- Inputs are protected against short circuits to GND and supply.
- High resolution, 16-bits, analog inputs.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- CANbus serial interface.
- RS232 serial interface.
- Especially designed to drive up to 6 electro-hydraulic proportional actuators Tecnord type MLT-FD4/5.
- Auxiliary +5 V supply for control devices (e.g. potentiometers).
- Performance Level c capability according to ISO 13849, due to high reliability of components and embedded diagnostics.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage:</td>
<td>8÷32 VDC</td>
</tr>
<tr>
<td>Max current consumption:</td>
<td>0.5 A (no load applied)</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-25°C to +85°C</td>
</tr>
<tr>
<td>Degree of protection:</td>
<td>IP 67</td>
</tr>
<tr>
<td>Analog inputs (10 bits):</td>
<td>8 (0-5 V)</td>
</tr>
<tr>
<td>Input impedance:</td>
<td>100 kΩ</td>
</tr>
<tr>
<td>Typical ctrl pot resistance:</td>
<td>1÷10 kΩ</td>
</tr>
<tr>
<td>Digital inputs:</td>
<td>14</td>
</tr>
<tr>
<td>High side power outputs:</td>
<td>12 (3.5 A max)</td>
</tr>
<tr>
<td>PWM current feedback:</td>
<td>1</td>
</tr>
<tr>
<td>Max current load on all outputs</td>
<td>10 A</td>
</tr>
<tr>
<td>Analog outputs:</td>
<td>6 (0-5 V)</td>
</tr>
</tbody>
</table>

**APPLICATIONS**

- 12 VDC and 24 VDC systems.
- Closed loop systems with electro-hydraulic proportional actuators.
- General purpose applications requiring field-adjustments.
- MMS-2218 can be connected to a CANbus network (J1939 or CANopen).

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**ORDERING INFORMATION**

**EC-MMS-2218-H**  
2218 = 22 inputs - 18 outputs  
H = potted plastic Housing for panel mounting
EC-MMS-1521-H MACHINE MANAGEMENT SYSTEM CONTROLLER

DESCRIPTION

MMS (Machine Management System) controller in rugged aluminum enclosure dual microprocessor, CANbus, built-in safety and fault-detection features for integrated control of complex functions in mobile equipment applications.

OPERATION

It is normally used as the main control unit in a complete management system. Two microprocessors and advanced diagnostics for safety applications. The EC-MMS-1521 comes with an aluminum casing, a silicon rubber gasket and connectors, designed to ensure power dissipation, robustness and tightness required in severe environment conditions. Software download available.

FEATURES

• Robust aluminum enclosure.
• Power supply is protected against reversed polarity (external fuse required) and overvoltage.
• Inputs are protected against short circuits to GND and power supply.
• Outputs protected against short circuits, over-current and over-temperature.
• 2 CANbus connections.
• PWM drivers with current feedback.
• +5 V auxiliary power supply for external control devices.
• Performance level d capability according to ISO 13849, thanks to redundant microcontroller and embedded diagnostics.
• Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).
• Reserved power supply pins for safety power outputs.
• Optional add-on inclinometer.
• Optional real time clock for data logging.

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>8÷32 VDC</td>
</tr>
<tr>
<td>Max. current consumption</td>
<td>&lt; 400 mA (no load applied)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40°C / +105°C</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 69</td>
</tr>
<tr>
<td>Analog inputs (16 bits)</td>
<td>3 (0-5 V)</td>
</tr>
<tr>
<td>Analog inputs (10 bits)</td>
<td>8 (0-5 V)</td>
</tr>
<tr>
<td>Digital (frequency) inputs</td>
<td>4</td>
</tr>
<tr>
<td>High side power outputs</td>
<td>18 (6 if PWM outputs are used)</td>
</tr>
<tr>
<td>Low side power outputs (LS)</td>
<td>2</td>
</tr>
<tr>
<td>PWM outputs with current feedback (3A):</td>
<td>12</td>
</tr>
<tr>
<td>Analog voltage outputs (0-5 V):</td>
<td>1</td>
</tr>
<tr>
<td>Pins selectable as power OUT or digital IN:</td>
<td>6</td>
</tr>
<tr>
<td>Inputs with SW selectable pull-up:</td>
<td>4</td>
</tr>
<tr>
<td>CANbus lines</td>
<td>2 (ISO 11898, CAN 2.0A/B)</td>
</tr>
<tr>
<td>Available bus speed</td>
<td>up to 1 Mbit/s</td>
</tr>
</tbody>
</table>

APPLICATIONS

• Main ECU for aerial platforms, cranes, telehandlers, agriculture vehicles.
• 12 VDC and 24 VDC systems.
• Two or more MMS boards can be interconnected through the CANbus line.

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
EC-MMS-1521-H  MACHINE MANAGEMENT SYSTEM CONTROLLER

CIRCUIT BOARD PINOUT - WIRING DIAGRAM

Connector type: framatome SICMA2

J3 (GREY)
A
1 VHS4
2 OUT_PWM7
3 OUT_PWM2
4 OUT_PWM3
5 DIG INT 1
6 DIG INT 0
7 OUT_PWM4
8 VHS3

B
1 LS1
2 OUT_PWM6
3 ANALOG IN 8
4 ANALOG IN 10
5 DIG INT 3
6 DIG INT 2
7 OUT_PWM5
8 VHS2

C
1 LS0
2 SV EXT
3 ANALOG IN 9
4 CAN L 1
5 CAN H 1
6 CAN L 2
7 CAN H 2
8 VHS1

J4 (BLACK)
A
1 OUT 4
2 OUT 5
3 OUT 0
4 OUT 1
5 OUT_PWM8
6 OUT_PWM9
7 OUT_PWM10
8 +V (POWER SUPPLY)

B
1 OUT 2
2 OUT 3
3 ANALOG IN 1
4 ANALOG IN 3
5 ANALOG IN 5
6 ANALOG IN 7
7 OUT_PWM11
8 -V (POWER SUPPLY - GND)

C
1 OUT_PWM0
2 OUT_PWM1
3 ANALOG IN 0
4 ANALOG IN 2
5 ANALOG IN 4
6 ANALOG IN 6
7 OUT AN 0
8 -V (POWER SUPPLY - GND)

ADJUSTMENTS

MMS controllers have a customized firmware to fulfill machine functions. A customized calibration tool is available to set main working parameters.

APPLICATION EXAMPLE

Electric motor variable RPM control

Forklift control system

ORDERING INFORMATION

EC-MMS-1521-H

1521 = 15 inputs - 21 outputs
H = aluminium Housing
EC-MMS-4820-H  MACHINE MANAGEMENT SYSTEM

DESCRIPTION

MMS (Machine Management System) coding card with CANbus and RS485 interface and built-in advanced safety and fault-detection features for integrated control of mobile equipment functions.

OPERATION

The MMS-4820 can be lodged inside any remote control box or panel to make command signals compatible with CANbus networks or RS485 serial lines.

It can be used as a stand-alone controller for Tecnord’s Multidrom MLT/FD5 CANbus-configured electro-hydraulic proportional actuators. It can be used as a remote coding card for RS485 serial line connection to other MMS electronic units like Tecnord’s Mod. MMS-2218.

FEATURES

- Power supply line is protected against reversed polarity and overvoltage.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- 2-wires CANbus or RS485 serial interface.
- Performance level d capability according to ISO 13849, thanks to microprocessor redundancy.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).
- Auxiliary +5 V supply for control devices (e.g. potentiometers).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>8.5÷40 VDC</td>
</tr>
<tr>
<td>Max current consumption</td>
<td>0.5 A (no load applied)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25°C / +85°C</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 54</td>
</tr>
<tr>
<td>Input impedance</td>
<td>100 kΩ</td>
</tr>
<tr>
<td>Analog inputs (10 bits)</td>
<td>16 (0-5 V)</td>
</tr>
<tr>
<td>Typical ctrl pot resistance</td>
<td>1÷10 kΩ</td>
</tr>
<tr>
<td>Digital inputs</td>
<td>32</td>
</tr>
<tr>
<td>High side power outputs</td>
<td>4 (3.5 A max)</td>
</tr>
<tr>
<td>Max current load on all outputs</td>
<td>5 A</td>
</tr>
<tr>
<td>High side signal outputs</td>
<td>16 (0.7 A max)</td>
</tr>
<tr>
<td>Inputs for current feedback</td>
<td>1</td>
</tr>
<tr>
<td>Current output range (PWM)</td>
<td>100÷1500 mA</td>
</tr>
<tr>
<td>PWM dither frequency</td>
<td>60÷200 Hz (adjustable)</td>
</tr>
</tbody>
</table>

APPLICATIONS

- 12 VDC and 24 VDC systems.
- Control panel management.
- Field-adjustable applications.
- Closed loop systems with electro-hydraulic digital actuators.
- Two or more MMS boards can be interconnected by means of 2-wires RS485 serial lines or CANbus where rotating joints or cable reels are installed.

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
CIRCUIT BOARD PINOUT - WIRING DIAGRAM

Connector type: Molex MINIfit

<table>
<thead>
<tr>
<th>J1</th>
<th>J6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>+V (POWER SUPPLY)</td>
<td>POWER OUT 1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5V EXT</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CANH / RS485+</td>
<td>PWM CURRENT FEEDBACK</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>CANL / RS485-</td>
<td>POWER OUT 2</td>
</tr>
<tr>
<td>5÷12</td>
<td>5÷12</td>
</tr>
<tr>
<td>ANALOG IN [1÷8]</td>
<td>POWER OUT 3</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>-V (POWER SUPPLY - GND)</td>
<td>RESET</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>PROG1 (#1 MICROCONTROLLER)</td>
<td>PROG2 (#2 MICROCONTROLLER)</td>
</tr>
<tr>
<td>16</td>
<td>17÷24</td>
</tr>
<tr>
<td>Reset</td>
<td>ANALOG IN [9÷16]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J2+J5</th>
<th>J7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1÷8</td>
<td>1÷16</td>
</tr>
<tr>
<td>DIGITAL IN [1÷32]</td>
<td>SIGNAL OUT [1÷16]</td>
</tr>
</tbody>
</table>

ADJUSTMENTS

MMS controllers have a customized firmware to fulfill machine functions. A customized calibration tool is available to set main working parameters.

APPLICATION EXAMPLE

Electro-hydraulic system with MLT digital actuators controlled via 2-wires CANbus line.

ORDERING INFORMATION

EC-MMS-4820-H

4820 = 48 inputs - 20 outputs

H = potted plastic Housing for panel mounting

WARNING: The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
EC-MMS-0713-H  MACHINE MANAGEMENT SYSTEM

DESCRIPTION

MMS (Machine Management System) controller with built-in advanced driving and fault-detection features to be used as a stand-alone unit or in connection with other CANbus units (e.g. joysticks, MLTs, radio, other MMS).

OPERATION

EC-MMS-0713 can be used as a stand-alone controller for applications with a single PWM or dual proportional manifolds where the functions are operated in meter-in configuration. Its CANbus interface allows it to be used as a part of complex CAN networks e.g. equipped with radio systems. EC-MMS-0713 is provided with display and push-buttons to configure the control characteristics (Imin/Imax, ramps, deadbands, dither) of its PWM output channels.

FEATURES

- Power supply line is protected against reversed polarity and overvoltage.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, over-current and over-temperature.
- CANbus (CAN 2.0B) interface
- Internal measurement of battery voltage.
- The current in the proportional solenoids is independent of change in the coil resistance and supply voltage variations.
- Especially designed for applications with manifolds in meter-in configuration (single or dual proportional).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage:</td>
<td>8.5÷32 VDC</td>
</tr>
<tr>
<td>Max current consumption:</td>
<td>0.25 A (no load applied)</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-25°C / +85°C</td>
</tr>
<tr>
<td>Degree of protection:</td>
<td>IP 65 (with housing)</td>
</tr>
<tr>
<td>Analogue inputs:</td>
<td>1, 10-bits resolution</td>
</tr>
<tr>
<td>Analogue input type:</td>
<td>0÷20 mA or 0÷5 V selectable by sw</td>
</tr>
<tr>
<td>(HW option 0÷10 V)</td>
<td></td>
</tr>
<tr>
<td>Digital inputs:</td>
<td>6</td>
</tr>
<tr>
<td>Input impedance:</td>
<td>100kΩ (internal pull-down)</td>
</tr>
<tr>
<td>Max current load on all outputs:</td>
<td>10 A</td>
</tr>
<tr>
<td>High Side power outputs:</td>
<td>13 (3.5A max each)</td>
</tr>
<tr>
<td>(HW option: 14-one digital input not available)</td>
<td></td>
</tr>
<tr>
<td>Current output range (PWM):</td>
<td>3 A</td>
</tr>
<tr>
<td>Available current feedbacks:</td>
<td>2 (on the high side)</td>
</tr>
<tr>
<td>(HW option: 4)</td>
<td></td>
</tr>
</tbody>
</table>

APPLICATIONS

- 12 VDC and 24 VDC systems.
- For hand held terminal cable/radio applications.
- Field - adjustable applications.
- Machine management systems based on CANbus.

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.

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mail: tecnord@tecnord.com • www.tecnord.com
EC-MMS-0713-H  MACHINE MANAGEMENT SYSTEM

CIRCUIT BOARD PINOUT - WIRING DIAGRAM

Connector type: Deutsch - DTM12

A (GREY)
1 DI1 (DIGITAL INPUT)
2 EVP1 (HS OUTPUT WITH CURRENT FEEDBACK)
3 -V (POWER SUPPLY - GND)
4 EVP2 (HS OUTPUT WITH CURRENT FEEDBACK)
5 HS11 (HIGH SIDE OUTPUT)
6 +V (POWER SUPPLY - POSITIVE)
7 HS1 (HIGH SIDE OUTPUT)
8 HS2 (HIGH SIDE OUTPUT)
9 HS3 (HIGH SIDE OUTPUT)
10 HS4 (HIGH SIDE OUTPUT)
11 HS5 (HIGH SIDE OUTPUT)
12 HS6 (HIGH SIDE OUTPUT)

B (BLACK)
1 HS7 (HIGH SIDE OUTPUT)
2 HS8 (HIGH SIDE OUTPUT)
3 DI2 (DIGITAL INPUT)
4 DI3 (DIGITAL INPUT)
5 HS9 (HIGH SIDE OUTPUT)
6 HS10 (HIGH SIDE OUTPUT)
7 CAN HIGH
8 CAN LOW
9 AIN (ANALOGUE INPUT)
10 DI4 (DIGITAL INPUT)
11 DI5 (DIGITAL INPUT)
12 DI6 (DIGITAL INPUT)

ADJUSTMENTS

Adjustments through integrated display and pushbuttons

APPLICATION EXAMPLE

One MMS connected to a portable control unit through a CANbus line.
Radio connection available.

ORDERING INFORMATION

EC-MMS-0713-H

0713 = 7 inputs - 13 outputs

H = potted plastic Housing for panel mounting

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
DESCRIPTION
MMS (Machine Management System) controller with built-in advanced safety and fault-detection features for integrated control of a high number of functions in mobile equipment applications.

OPERATION
It is normally used as the main control unit in a complete machine management system. Two microprocessors and advanced diagnostics for safety applications. CANbus communication. Serial connection for software download.

FEATURES
- Robust metal enclosure and complete potting.
- Power supply line is protected against reversed polarity and overvoltage.
- Inputs are protected against short circuits to GND and supply.
- Outputs are protected against short circuits, reversed polarity, over-current and over-temperature.
- Dual microprocessor for advanced diagnostics capability.
- Optional add-on inclinometer.
- +5 V auxiliary power supply for external control devices.
- Performance level d capability according to ISO 13849, thanks to redundant microcontroller and embedded diagnostics.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity), EN 61000-6-3 (Emissions).

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage:</td>
<td>8.5÷32 VDC</td>
</tr>
<tr>
<td>Max current consumption:</td>
<td>400 mA (no load applied)</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-25°C / +85°C</td>
</tr>
<tr>
<td>Degree of protection:</td>
<td>IP 67</td>
</tr>
<tr>
<td>Input impedance:</td>
<td>100 kΩ</td>
</tr>
<tr>
<td>Analog inputs (10 bits):</td>
<td>16 (0-5 V), 6 (0-20 mA)</td>
</tr>
<tr>
<td>Typical ctrl pot resistance:</td>
<td>1÷10 kΩ</td>
</tr>
<tr>
<td>High side power outputs:</td>
<td>8 (5 A max), 28 (3.5 A max)</td>
</tr>
<tr>
<td>High side signal outputs:</td>
<td>10 (0.7 A max)</td>
</tr>
<tr>
<td>Digital inputs:</td>
<td>40</td>
</tr>
<tr>
<td>Max current load on all outputs:</td>
<td>16 A</td>
</tr>
<tr>
<td>Inputs for current feedback:</td>
<td>4</td>
</tr>
<tr>
<td>Current output range (PWM):</td>
<td>100÷1600 mA</td>
</tr>
<tr>
<td>Analog voltage outputs:</td>
<td>6 (0-5 V)</td>
</tr>
</tbody>
</table>

APPLICATIONS
- 12 VDC and 24 VDC systems.
- Main ECU for aerial platforms, cranes, telehandlers, agric. machines.
- Field-adjustable applications.
- Two or more MMS boards can be interconnected by means of 2-wires RS485 serial lines or CANbus.

WARNING: The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described herein. Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
CIRCUIT BOARD PINOUT - WIRING DIAGRAM

Main Connectors type: SICMA2/DCS1 (56 poles)
Auxiliary connector type: SICMA2 (24 poles)
PC connector type: DB15 female

For wiring schematics consult factory.

ADJUSTMENTS

MMS controllers have a customized firmware to fulfill machine functions. A customized calibration tool is available to set main working parameters.

APPLICATION EXAMPLE

Two configuration available:
Standard (2 main connectors)
Full (all connectors)

EC-MMS-6252-H
6252 = 62 inputs - 52 output
H = stainless steel Housing
WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described herein. Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
### Graphic Display Units

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-VIS-G-D128X64-P</td>
<td>Graphic color display 128x64</td>
<td>EC34</td>
</tr>
<tr>
<td>EC-VIS-G-D128x64-M-C</td>
<td>Graphic display 128x64 dots (192 kB eeprom)</td>
<td>EC36</td>
</tr>
<tr>
<td>EC-VIS-GC-P480x272-S</td>
<td>Graphic color display 480x272 pixels (64 kB eeprom)</td>
<td>EC38</td>
</tr>
</tbody>
</table>
EC-VIS-G-D128X64-P  GRAPHIC DISPLAY UNIT

DESCRIPTION

Graphic Display Unit to be used as operator’s interface in complex Machine Management Systems.

FEATURES

- Compact control unit to be fixed inside a cabin.
- Robust suction cup on the rear.
- CANbus connection.
- Graphic display 128 x 64 dots backlit.

MECHANICAL / ENVIRONMENTAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>131 x 100.5 x 20.8 mm</td>
</tr>
<tr>
<td>Housing</td>
<td>Plastic body</td>
</tr>
<tr>
<td>Membrane keypad</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25 / 85°C</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 67</td>
</tr>
<tr>
<td>Connector</td>
<td>Molex Minifit 20 poles</td>
</tr>
</tbody>
</table>

ELECTRICAL SPECIFICATIONS

| Display Type and Size        | graphic        |
| Resolution                  | 128 x 64 dot-matrix |
| Viewing area                | 50 x 25 mm      |
| Backlight                   | led             |
| Backlight color             | white           |
| Viewing angle range         | 40°             |

ELECTRONIC CONTROL UNIT

| Operating voltage           | 8.5÷30 VDC     |
| Communication interfaces    | CANbus         |
|                            | SAE J1939      |
| Analog inputs (10 bits)     | 4 (0-5 V)      |
| Digital inputs              | 5              |
| High side power outputs     | 4 (3.5 A max each) |
| Internal inputs             |                |
| for current feedback        | 4              |
| PWM output current range    | 100 - 1500 mA  |
| Membrane keypad with        |                |
| Pushbuttons                 | 9              |
| SMD leds                    | 9              |
| Control potentiometer on the top | 1         |

APPLICATIONS

- 12 VDC and 24 VDC systems.
- Service/Maintenance Tool.
- Diagnostic/Configuration unit for Hedgecutters.
- In-cab terminal.
**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

Connector type: Molex Minifit

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-V (POWER - GND)</td>
</tr>
<tr>
<td>2</td>
<td>CAN H</td>
</tr>
<tr>
<td>3</td>
<td>ANALOG IN 2</td>
</tr>
<tr>
<td>4</td>
<td>ANALOG IN 0</td>
</tr>
<tr>
<td>5</td>
<td>DIGITAL IN 2</td>
</tr>
<tr>
<td>6</td>
<td>DIGITAL IN 0</td>
</tr>
<tr>
<td>7</td>
<td>DIGITAL IN 4</td>
</tr>
<tr>
<td>8</td>
<td>OUT P1</td>
</tr>
<tr>
<td>9</td>
<td>N.C.</td>
</tr>
<tr>
<td>10</td>
<td>N.C.</td>
</tr>
<tr>
<td>11</td>
<td>+V (POWER)</td>
</tr>
<tr>
<td>12</td>
<td>CAN L</td>
</tr>
<tr>
<td>13</td>
<td>ANALOG IN 3</td>
</tr>
<tr>
<td>14</td>
<td>ANALOG IN 1</td>
</tr>
<tr>
<td>15</td>
<td>DIGITAL IN 3</td>
</tr>
<tr>
<td>16</td>
<td>DIGITAL IN 1</td>
</tr>
<tr>
<td>17</td>
<td>OUT P0</td>
</tr>
<tr>
<td>18</td>
<td>OUT P2</td>
</tr>
<tr>
<td>19</td>
<td>OUT P3</td>
</tr>
<tr>
<td>20</td>
<td>+5 V EXT</td>
</tr>
</tbody>
</table>

**APPLICATION EXAMPLE**

**ORDERING INFORMATION**

EC-VIS-G-D128X64-P  
P = Plastic enclosure  
D = 128 x 64 Dots  
G = Graphic display

**WARNING:** The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
EC-VIS-G-D128X64-M-C  GRAPHIC DISPLAY UNIT

DESCRIPTION
Graphic display unit to be used as operator’s interface in complex Machine Management Systems.

FEATURES
• RS-232 serial interface.
• 1 CANbus connection.
• Graphic display 128 x 64 dots backlit.
• Real time clock with calendar.
• Wide data storage memory.

MECHANICAL / ENVIRONMENTAL SPECIFICATIONS

| Dimensions:       | 174 x 108 x 31 mm                     |
| Operating temperature: | -25°C / 85°C                         |
| Degree of protection: | IP 67                               |
| Connector:         | SCI M2, 24 pin                        |

ELECTRICAL SPECIFICATIONS

Display
| Type and size: | Graphic                                   |
| Resolution:    | 128 x 64 dot-matrix                       |
| Viewing area:  | 62 x 44 mm                                |
| Brightness:    | 8 cd/m²                                   |
| Contrast:      | 8:1                                       |
| Viewing angle range: | 40°                                    |

APPLICATIONS
• 12 VDC and 24 VDC systems.
• Load limiter and/or area control systems.
• In-cab terminal.
• Data logger.

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**EC-VIS-G-D128X64-M-C**

**GRAPHIC DISPLAY UNIT**

**CIRCUIT BOARD PINOUT - WIRING DIAGRAM**

**APPLICATION EXAMPLE**

**ORDERING INFORMATION**

**Connector type:** SICMA2 (24 poles)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-V (POWER - GND)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>ANALOG IN 1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>ANALOG IN 2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>DIGITAL IN</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>ANALOG IN 5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>ANALOG IN 6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>OUT 1</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>OUT 0</td>
<td>8</td>
</tr>
</tbody>
</table>

**EC-VIS-G-D128X64-M-C**

C = Cabin mount
M = Metal enclosure
D = 128 x 64 Dots
G = Graphic display
EC-VIS-GC-P480X272-S  GRAPHIC DISPLAY UNIT

DESCRIPTION
Color graphic display unit.

FEATURES
- Dual-molding plastic-silicon enclosure.
- 4.3" TFT backlit color display.
- Stand alone or dashboard mount.
- 6 push buttons (backlit), 6 LEDs.
- CANbus interface.
- Electro Magnetic Compatibility (EMC): EN 61000-6-2 (Immunity)
  EN 61000-6-3 (Emissions)
- Auxiliary +5 V supply for external devices (e.g. sensors).

MECHANICAL / ENVIRONMENTAL SPECIFICATIONS
- Dimensions: 182 x 117 x 49 mm
- Housing: polycarbonate body
  soft silicon rubber cover
- Operating temperature: -25°C / 85°C
- Degree of protection: IP 65
- Connector: AMP superseal, 26 pin

ELECTRICAL SPECIFICATIONS
- Display
  Type and size: TFT, 4.3", 16:9
  Resolution: 480 x 272 pixels
  Viewing area: 95.04 x 53.856 mm
  Brightness: 280 cd/m²
  Contrast: 450:1
  Viewing angle range: ±70° H, +70/-50° V
- Operating voltage: 8÷32 VDC
- Communication interfaces: CANbus ISO11898
  RS 232
  USB
- Analog inputs (10 bits): 8 (0-5 V)
- Additional features:
  real time clock
  4 analog inputs
- Input impedance: 100 kΩ
- Max. current from +5 V auxiliary out: 25 mA

APPLICATIONS
- System diagnostic for heavy duty vehicles.
- Diagnostic/configuration unit for telehandlers.
- Service/maintenance tool.
- Data logger.

WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
EC-VIS-GC-P480X272-S  GRAPHIC DISPLAY UNIT

CIRCUIT BOARD PINOUT - WIRING DIAGRAM

Connector type: AMP Superseal 1.00 mm, 26 pin

MOUNTING OPTIONS

Dashboard Mount

Panel cutout of 177 x 112 mm

Cabin Mount

N. 4 Fixing holes for M4 screws at 75 x 50 mm

ORDERING INFORMATION

EC-VIS-GC-P480X272-S- *

D = Dashboard mount
C = Cabin mount
S = polycarbonate with Silicon cover
P = 480 x 272 Pixels
GC = Graphic Color Display

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WARNING: the specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
## ACCESSORIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control unit connection</td>
<td>Connector kits</td>
<td>EC42</td>
</tr>
<tr>
<td>Control unit calibration tool</td>
<td>Software calibration tool linking cables</td>
<td>EC44</td>
</tr>
<tr>
<td>Cables</td>
<td>Linking Cables</td>
<td>EC45</td>
</tr>
</tbody>
</table>
6 POLES DEUTSCH DT04-6P
Kit includes: female connector, male contacts, secondary lock and fillers
Available for electronic control unit: EC-MMS-1012-H
ORDERING CODE: 13.0310.386

8 POLES DEUTSCH DT06-8S
Kit includes: male connector, female contacts, secondary lock and fillers
Available for electronic control unit: EC-PWM-A2-MPC1-H
ORDERING CODE: 13.0310.432

12 POLES “DEUTSCH DTM06-12SA & DTM06-12SB”
Kit includes: male connector, female contacts, secondary lock and fillers
Available for electronic control unit: EC-MMS-0713-H
ORDERING CODE: 13.0310.253

26 POLES AMP SUPERSEAL
Kit includes: male connector, female contacts
Available for electronic control unit: EC-VIS-GC-P480x272-S
ORDERING CODE: 13.0310.635
CONNECTOR KITS

**24 POLES SICMA BLACK COLOR**

Kit includes: male connector, female contacts, locking cum, fillers
Available for electronic control unit: EC-PWM-P4-MPC2-H; EC-PWM-P8-MPC4-H; EC-PWM-08-MPC4-H; EC-MMS-1012-H; EC-MMS-2218-H; EC-MMS-1521-H

ORDERING CODE: 13.0310.150

**24 POLES SICMA GREY COLOR**

Kit includes: male connector, female contacts, locking cum, fillers
Available for electronic control unit: EC-MMS-1521-H

ORDERING CODE: 13.0310.634

**24 POLES SICMA BLACK COLOR WITH WIRES 0.8 M LENGTH**

Kit includes: male connector, female contacts, locking cum and wires 0.8 m length
Available for electronic control unit: EC-PWM-P4-MPC2-H; EC-PWM-P8-MPC4-H; EC-PWM-08-MPC4-H; EC-MMS-1012-H; EC-MMS-2218-H; EC-MMS-1521-H

ORDERING CODE: 13.0310.236

**56 POLES SICMA**

Kit includes: male connector, female contacts, locking cum, cover and fillers
Available for electronic control unit: EC-MMS-6252-H

ORDERING CODE: 13.0310.324

**56 POLES SICMA WITH WIRES 0.8 M LENGTH**

Kit includes: male connector, female contacts, locking cum, cover and fillers
Available for electronic control unit: EC-MMS-6252-H

ORDERING CODE: 13.0310.868

WARNING: The specifications/application data shown in our catalogs and data sheets are intended only as a general guide for the product described (herein). Any specific application should not be undertaken without independent study, evaluation, and testing for suitability.
TECNORD SOFTWARE ELECTRONIC UNITS CALIBRATION TOOL

Tecnord electronic control units are supplied with operation parameters standard programming, which satisfies most applications. For special application SCT calibration software allows some of the parameters for proportional solenoid valve control to be modified via computer; for example the minimum and maximum current or ramp up and ramp down parameters may be defined. The linking cable shown in the following page (optional, to be ordered separately) is necessary for the computer connection.

MINIMUM SYSTEM REQUIREMENTS

- Windows XP® operating system or higher.
- Intel® Pentium processor.
- 32 Mb RAM.
- CD player unit.
- Connecting through a standard RS232 serial port, DB9 connection; alternatively, a USB-RS232 converter can be used.

PROGRAM INSTALLATION

To install the SCT software onto a personal computer, simply execute the file setup.exe.
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**LINKING CABLES**

**AMPSEAL-DB9 CABLE ADAPTER** (with software calibration tool)
Available for electronic control unit: EC-PWM-P4; EC-PWM-P8; EC-MMS-1012-H
ORDERING CODE: 20.1001.026/A

**DEUTSCH-DB9 LINKING CABLE** (with customized software calibration tool)
Available for electronic control unit: EC-MMS-2218-H
ORDERING CODE: 21.0801.031

**DB15-DB9 LINKING CABLE** (with software calibration tool)
Available for electronic control unit: EC-MMS-6252-H
ORDERING CODE: 21.0801.053

**RS232 - USB CONVERTER**
It allows Tecnord electronic control units to personal computer connection when the latter is unprovided of serial port; for installation follow the instruction enclosed with the converter
ORDERING CODE: 21.0801.039

**CAN - USB CONVERTER**
It allows Tecnord CAN joysticks to Personal Computer connection with a USB port; for installation follow the instruction enclosed with the interface device
ORDERING CODE: 21.0801.040
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