HydraForce
POWER FORWARD

# ELECTRONICS PRODUCT GUIDE

# EASY
# POWERFUL
# ROBUST

*A rugged line of electronic valve drivers, control units, operator interfaces, sensors designed specifically for the demanding mobile hydraulic equipment markets.*

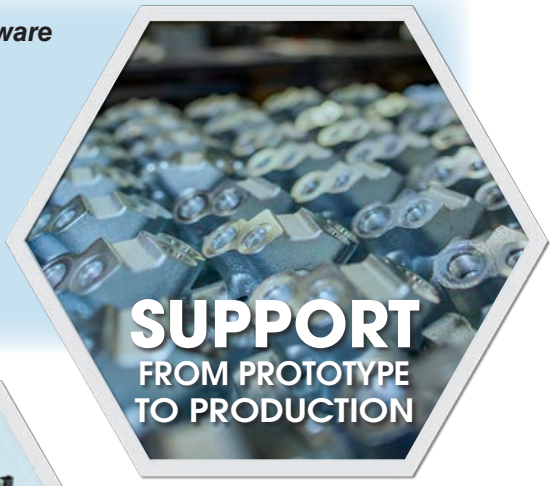
www.hydraforce.com

# HydraForce — Your ElectroHydraulic Source

## Why buy HydraForce ElectroHydraulic Systems? Here are the reasons:


- *World's largest privately owned cartridge valve manufacturer focused on EH system controls*
- *Broadest range of cartridge product*
- *Designed EH systems for mobile equipment in every industry*

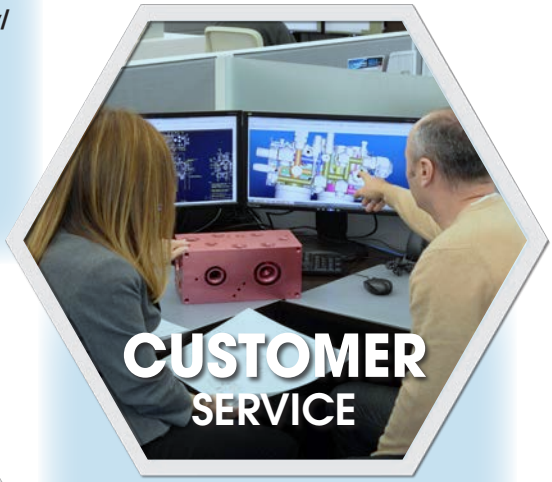
- *Simulation software*
- *Fast prototypes*
- *In-house rapid prototype machinery*





- *All hydraulic functions in a single manifold*
- *Simplified circuit design*
- *Flashed and good-to-go controllers*
- *Sensors, integrated into manifolds for one easy-to -order part number*


- *ISO 9001 certified*
- *All controllers performance tested to construction/mining/forestry/ agricultural standards*
- *Use of Lean and Six Sigma practices*
- *Industry-leading warranty on manifolds and valves*



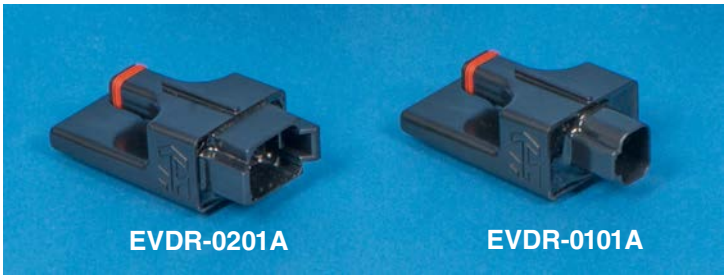

- *Flexible Delivery Scheduling*
- *Exceptional Customer Service rated above average by our customers*

- *Free configuration software for all HydraForce brand controllers*
- *Customized templates that save engineering time*
- *Built-in libraries of drag & drop building blocks*

# EVDR Electronic Valve Drivers/Sensors

## EVDR proportional valve drivers are pre-configured for convenient application on general purpose, time-based, or reversing fan controls.

Input signals trigger the output, which follows a defined metering profile. ExDR-0101A drivers have one input and one output. ExDR-0201A drivers have one or two outputs and one input. *HF-Impulse* software is used to tune EVDR controllers.




### EVDR-0101A, General Purpose Electronic Valve Driver, Part No. 4204800

The EVDR-0101A has one input and one output. It can accept input from analog or digital operator interface devices. As the input changes, the output follows a defined metering profile. An LED indicator light on the front provides quick status check and fault detection. Uses *HF-Impulse* configuration software. Development Cables: P/N 4000285, 4000286

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Digital In (SWG/ SWB) | Pulse (PWM/ Freq) | Analog V/I/R | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 1 | x | x | x | x | x | | |
| 1 | | | | | | x | x |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

### ETDR-0101A, Time-Based Valve Driver, Part No. 4204810

The ETDR-0101A is a time-based valve driver that allows time-based shaping of the output for transmission/clutch control, soft start, hotshot or other applications. The input signal triggers the output sequence. You can define six output levels and their duration in milliseconds. You can also define the ramp down rate for output to fall back to zero after sequence completes. Uses *HF-Impulse* configuration software. Development Cables: P/N 4000285, 4000286

### EVDR-0201A, General Purpose Electronic Valve Driver, Part No. 4204700

The EVDR-0201A has two ouputs and one analog or digital input. You can also use this driver with SAE J1939 operator interface devices. As the input changes, the output follows a defined metering profile – either straight-line or dual-sloped output. The EVDR-0201A uses *HF-Impulse* configuration software and has LED indicator lights for quick status check and fault detection. Development Cables: P/N 4000304, 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Digital In (SWG/ SWB) | Pulse (PWM/ Freq) | Analog V/I/R | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 1 | x | x | | x | x | | |
| 2 | | | | | | x | x |
| 3 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |

### EVDR-0201A Development Kit, Part No. 4210080

The EVDR Development Kit is a fast and cost-effective way to get started applying the EVDR-0201A controllers. The Kit has everything you need to get started - an EVDR-0201A controller, development harness and USB-to-CAN communications adapter. The Startup Guide, drivers and *HF-Impulse* software can be downloaded free from the HydraForce Electronics Portal. The EVDR Development Kit also offers a cost-savings over purchasing these items individually, so it's ideal for a first-time EVDR user.

### EFDR-0201A, Fan Control Electronic Valve Driver, Part No. 4204710

The EFDR-0201A is designed especially for proportional reversing fan drive control applications. You can scale fan speed to match input from a temperature sensor or respond to CAN messages from the engine control module. The control can reverse fan direction by user input or by CAN message. Uses *HF-Impulse* configuration software. Development Cables: P/N 4000304, 4000371

## *Sensors*


### ERT Temperature Sensor, Part No. 4206200

This cost-effective and reliable thermistor style heavy-duty analog temperature sensor has a padded resistor for improved linearity of the input curve.

### ERP Pressure Sensor, Part Nos. 4000650-654 and 4000655-659

This high-accuracy, heavy-duty series of pressure sensors offer 1% total error band accuracy accomplished by combining a high performance ASIC with a stable, field-proven, polysilicon, thin-film pressure sensor. These sensors are designed especially for use in demanding mobile equipment applications.

| 5 VDC Power Supply | | 9 to 36 VDC Power Supply | |
|---|---|---|---|
| 34 bar/500 psi | **Part No. 4000650** | 34 bar/500 psi | **Part No. 4000655** |
| 103 bar/1500 psi | **Part No. 4000651** | 103 bar/1500 psi | **Part No. 4000656** |
| 207 bar/3000 psi | **Part No. 4000652** | 207 bar/3000 psi | **Part No. 4000657** |
| 345 bar/5000 psi | **Part No. 4000653** | 345 bar/5000 psi | **Part No. 4000658** |
| 414 bar/6000 psi | **Part No. 4000654** | 414 bar/6000 psi | **Part No. 4000659** |

# ECDR Configurable Valve Drivers

**ECDR valve drivers are fully configurable to any hydraulic control application. Using *HF-Impulse* software, you can develop simple or complex control logic without writing code.**

*HF-Impulse* software lets you build control schemes using modular function blocks in a drag-and-drop configuration environment. Macro blocks allow you to create reusable function libraries while simplifying the logic diagram. With CAN 2.0B networking, ECDR valve drivers can interface with other controllers in a distributed control architecture. The larger ECDR-0506A can control other CAN devices, such as the ECDR-0201A, to expand control options as needed.


## ECDR-0201A, Configurable General Purpose Electronic Valve Driver, Part No. 4204740

The ECDR-0201A is a configurable controller with one input and two outputs. You can use it with analog, CANopen or SAE J1939 operator interface devices. It has the same amount of I/O as an EVDR-0201A but can be flexible in functionality. Two LED indicator lights provide quick status check and fault detection. Development Cables: P/N 4000304, 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Digital In (SWG/SWB) | Pulse (PWM/Freq) | Analog V/I/R | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 1 | x | x | x | x | x | | |
| 2 | | | | | | x | x |
| 3 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |

## ECDR-0203A, Configurable General Purpose Electronic Valve Driver, Part No. 4208230

The EVDR-0203A is a configurable controller with one or two outputs and three inputs that can be accepted from analog, CANopen or SAE J1939 operator interface devices. It has one LED indicator light for quick status check and fault detection. Development Cables: P/N 4000307, 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Digital In (SWG/SWB) | Pulse (PWM/Freq) | Analog V/I/R | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 3 | x | x | x | x | x | | |
| 2 | | | | | | x | x |
| 5 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |

## ECDR-0506A, Configurable General Purpose Electronic Valve Driver, Part No. 4208560

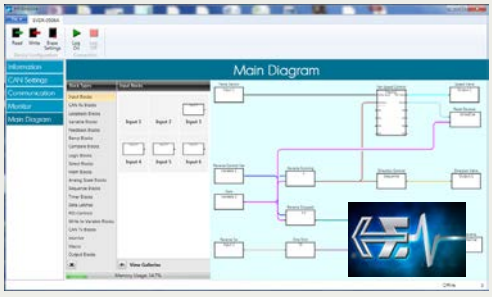
The ECDR-0506A is a configurable controller with five PWM outputs, including four closed loop outputs and one open loop output. There are six configurable inputs. Communication capabilities include CANopen and SAE J1939. It has one LED indicator light for quick status check and fault detection. Development Cables: P/N 4000307, 4000308, 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Digital In (SWG/SWB) | Pulse (PWM/Freq) | Analog V/I/R | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 4 | x | x | x | | x | | |
| 2 | x | x | | x | | | |
| 5 | | | | | | x | x |
| 11 | 6 | 6 | 4 | 2 | 4 | 5 | 5 |

## *HF-Impulse*™

### For HydraForce ExDR Valve Drivers and ECBP CAN Button Panels

*HF-Impulse* is an easy to use setup / configuration platform for the ExDR valve drivers and ECBP CAN button panels. The software allows you to flash devices with the latest firmware, change their "personality" from EVDR to EFDR or ETDR, and configure all parameters for operation. You can even monitor operation of the devices for performance testing and troubleshooting. Once the configuration parameters are set, simply download to the device.




**HydraForce *HF-Impulse* Features**

You can download *HF-Impulse* software free of charge on the HydraForce Electronics Portal at www.hydraforce.com/electronics.

- Set up and monitor configurable devices.
- Save settings to program multiple controllers for any given application (ideal for production environment.
- Set up through USB / CAN devices (controller dependent).
- Set up / monitor ECBP devices.
- Used for service tool setup/monitoring with ECU controlller.

# HydraForce Electronic Control Units

**For more sophisticated control schemes, these general purpose ECUs (Electronic Control Units) can be function as stand-alone controllers or for integration into a CAN network with other devices. They feature flexible input and output configuration.**

To configure HydraForce ECUs, download CoreTek Suite software, which has a customized version of CoDeSys programming software and a project template that allows fast and easy configuration of the controllers.


## ECU-0809, Part No. 4000350

This controller has inputs and outputs you can configure in multiple ways. Up to 21 inputs - digital, pulse, analog or current feedback. Up to 8 PWM outputs with 4 current feedbacks. 1 CAN port. 16/32-bit CPU, 100 MHz. Robust, light and leakproof housing protects the electronics from mechanical wear and exposure to moisture or chemicals. Three-point anchoring allows firm mounting on irregular surfaces. Development Cables: P/N 4000306, 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Pulse Input | Analog Input | Current Feed-back | PWM (Source) | Digital Out (Source) |
|---|---|---|---|---|---|---|---|
| 8 | x | | | | | x | x |
| 5 | | x | x | | | | |
| 4 | | x | | x | | | |
| 4 | | | | | x | | |
| 21 | 8 | 9 | 5 | 4 | 4 | 8 | 8 |

### ECU-0809 Development Kit, Part No. 4208000

The ECU-0809 Development Kit is a fast and cost-effective way to get started applying the ECU-0809 controllers. The Kit contains everything you need to get started - an ECU-0809 controller, development harness, and USB-to-CAN communications adaptor. The Startup Guide, drivers and *HF-Impulse* software can be downloaded free from the HydraForce Electronics Portal. The Development Kit also offers a cost-savings over purchasing these items individually.

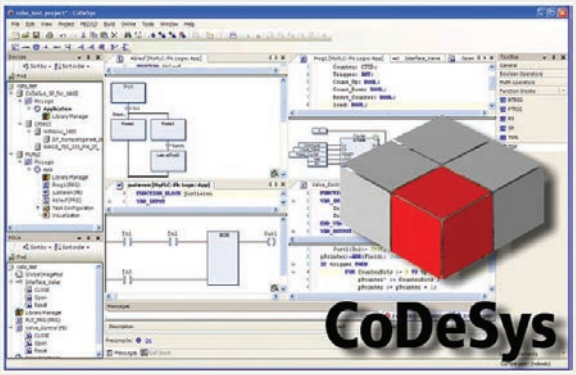
## ECU-3233, Part No. 4000343

This multi-function controller has a total of 65 I/O pins that have numerous functions in a control system, such as digital inputs and outputs, analog inputs, pulse inputs and proportional (PWM) outputs. 32-bit CPU, 128 MHz. Scalable for large or small machines with CANopen and PLCopen communication protocols. There are 4 CAN ports and one is equipped with duplicate pins to make cabling easier. This unit has the same type of housing and 3-point mounting as the ECU-0809. Development Cables: P/N 4000371

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Pulse Input | Analog Input | Current Feed-back | PWM (Source) | Digital Out (Source) | Digital Out (Sink) |
|---|---|---|---|---|---|---|---|---|
| 4 | | x | | | | x(4A) | x(4A) | |
| 4 | | x | | | x | x(2.5A) | x(2.5A) | |
| 12 | | x | | | x | x(2.5A) | x(2.5A) | |
| 8 | | x | | | | x(2.5A) | x(2.5A) | |
| 4 | | x | | | | | | x(3A) |
| 11 | x | x | | x | | | | |
| 18 | x | x | x | | | | | |
| 4 | | x | x | | | | | |

## CoDeSys™

CoDeSys or Controlled Development System is a complete development environment for PLCs. CoDeSys puts the powerful IEC language into your hands, enabling a simple approach to application development. The editors and debugging functions are based on the proven development program environments of advanced programming languages.




## For HydraForce Electronic Control Units (ECUs)

### HydraForce CoDeSys Features

You can download CoDeSys free of charge through the HydraForce Electronics Portal on www.hydraforce.com. It is packaged in CoreTek Suite.

HydraForce ECU controllers use an HF created template file to begin program creation.

- HydraForce ECU-Backbone is an all-in one I/O pin and CAN communication configuration tool. It allows you to configure modules, such as I/O pin assignment and CAN (SAE J1939, CANopen definitions prior to programming the device in the CoDeSys editor. This tool is also used to create the service tool.
- There is no cost to you to use CoDeSys with HydraForce ECUs.
- HydraForce ECU controllers use CoDeSys.

# ECU Controllers/ECBP CAN Button Panel

**The legacy HydraForce ECU-2415 and ECU-2820 electronic control units were the first to offer a variety of inputs and outputs for control of hydraulic functions.**

These controllers have an operating voltage of 9 to 30 VDC and operating current of 10 or 13 amps, a 16-bit microprocessor, and two ISO CAN 2.0B interfaces. They are CE-rated and have an environmental protection rating of IP67.

They have a 2-point mounting system and an optional shock cover for use in environments where the controller might be exposed to falling items, someone stepping on it, or water spray.

## ECU-2415

The **ECU-2415** has up to 49 inputs and 24 outputs, consisting of up to 24 PWM or digital high-side drivers to connect hydraulic devices. Development Cable: P/N 4000371

## ECU-2820

The **ECU-2820** has up to 52 inputs and 28 outputs, consisting of up to 24 PWM or digital high-side drivers and up to four digital low-side drivers. Development Cable: P/N 4000371

**ECU-2415; P/N 4000352 - Inputs and Outputs**

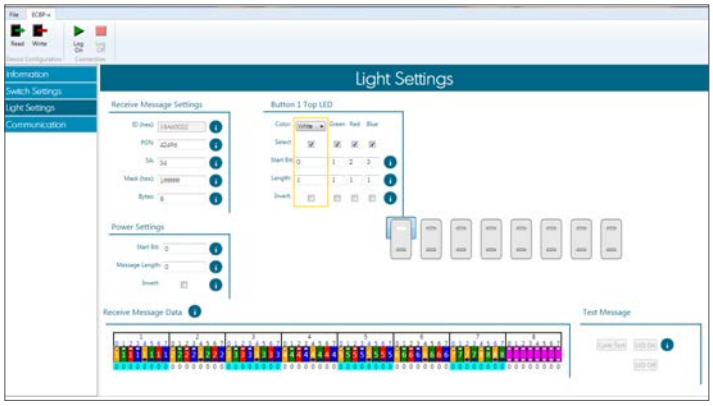
| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Pulse Input | Analog Input | Current Feed-back | PWM (Source) | Digital Out (Source) | Digital Out (Sink) |
|---|---|---|---|---|---|---|---|---|
| 1 | x | | | | | | | |
| 10 | | | | | x | | | |
| 6 | | x | | x | | | | |
| 8 | x | | x | | | | | |
| 8 | | x | | | | x | x | |
| 16 | x | | | | | x | x | |
| 49 | 25 | 14 | 8 | 6 | 10 | 24 | 24 | 0 |

**ECU-2820; P/N 4000356 - Inputs and Outputs**

| Max. I/O Count | Digital In (SWG) | Digital In (SWB) | Pulse Input | Analog Input | Current Feed-back | PWM (Source) | Digital Out (Source) (Source) | Digital Out (Sink) |
|---|---|---|---|---|---|---|---|---|
| 4 | | x | | | | | | |
| 4 | | | | | x | | | |
| 24 | | x | | | | x | x | |
| 8 | | x | | x | | | | |
| 4 | | x | | | | | | x |
| 8 | | x | x | | | | | |
| 52 | 0 | 48 | 8 | 8 | 4 | 24 | 24 | 4 |

## ECBP CAN (SAE J1939) Button Panel

The ECBP Electronic CAN Button Panel can be custom-configured with four to eight independently controlled LED switches. Interchangeable cams allow 1, 2 or 3 positions and detent or momentary action. The cams are designed on a simple snap-in platform that allows for easy and economical assembly and modification. You can configure the LEDs in up to 8 colors to indicate system status, with optional laser-etched icons. Download HF-Impulse software at www.hydraforce.com/electronics. The panel utilizes a patented system of optical interrupters to create a switch output with no electrical contacts within the switch. Cams are interchangeable.




***HF-Impulse*** **configuration screen for ECBP Button Panel**

**SPECIFICATIONS**

Voltage: 10-32 Vdc
Operating Current: 75 mA minimum, 350 mA maximum,
1.5 mA sleep
Mechanical Life: 250,000 cycles
Housing Material: UL 94V-0 polycarbonate - Actuator Lexan
Weight (8-position): Less than 0.375 lb (170 g)

**8-Button CAN Switch Panel**

**ENVIRONMENTAL RATINGS:**

Operating Temperature: –40°C to 85°C (–40°F to 185°F)
Humidity: 0 to 100 % condensing; Sealing: IP68
Shock: Mil. Std. 202 Method 213 Test Condition 1
Salt Spray: Mil. Std. 202G, Method 101E, Test Condition B, 48 hours
Thermal Shock: Mil. Std. 202 Method 107G Test Condition A-1, 5 cycles

| Part Number | Model Description |
|---|---|
| **Part No. 4000384** | ECBP-4, 4-Button CAN Switch Panel |
| **Part No. 4000385** | ECBP-5, 5-Button CAN Switch Panel |
| **Part No. 4000386** | ECBP-6, 6-Button CAN Switch Panel |
| **Part No. 4000387** | ECBP-7, 7-Button CAN Switch Panel |
| **Part No. 4000388** | ECBP-8, 8-Button CAN Switch Panel |

# Operator Controls/Displays

Through a systems integration partnership with Topcon/Wachendorff, HydraForce offers several operator displays to its lineup of electronic products. These rugged display units are programmable operator panels specifically designed for use with hydraulically powered mobile equipment. They offer the operator convenient and state-of-the-art control of hydraulic functions.

The display units are easy to program, using Java-based programming tool that allows any user to create customized screens, assign program button actions and configure CANbus messages.

A3 is a 4.3 inch (109 mm) color display with 8 programmable soft keys and 3 hard keys. The A6 is a larger, 7 inch (177 mm) color display with 12 programmable soft keys and three hard keys, a faster processor, audio-out interface and three video inputs. The A8 is a 12-inch unit. All displays are available in basic and full-featured models.


### RATINGS

**Display:** Sunshine-readable thin film transistor color graphic LCD. Light gray plastic housing with black rubber frame; glass front with anti-reflective foil surface.

**Encoder:** Electromechanical with mechanical detents and push mechanism rated for 1-million activations without electronic failure.

**Processor:** 32-bit, 532 MHz, I.MX35.

**Memory:** 128/256 MB DDR2; 512 MB / 1 GB Mass Storage; 32 kB serial EEPROM.

**Operating System:** Embedded Linux.

**Programming:** Wachendorff Projektor-Tool for Windows 7, 8, 10 supporting CANopen, Generic driver, CANfreestyle, J1939.

**Interfaces:** 2 CANbus ISO 11898, CAN specification 2.0 B active. 1 RS-232 (RxD, TxD, GND only), EIA-level. (Model A3S-Full only) 4 analog or digital inputs (selectable via software) 3 digital outputs, 1 USB 2.0 full speed on main connector, 1 USB 2.0 high speed on front, Ethernet 10/100 Mbit.

**Connectors:** Main connector: Tyco-AMP Super Seal, 26-pin. USB on main connector. (Model A3S-Full only) USB A on front panel; Ethernet: 4-pole round connector, M12, D-coded. Video: 5-pole round connector, M12, B-coded.

**Power Supply:** Designed for 12V and 24V battery system.

**Operating voltage range:** 8 to 36 VDC.

**Overvoltage resistance:** 48V for 2 minutes. Inverse polarity protection up to -48VDC.

**Environmental:** Operating Temperature: -30 to 65°C (-22 to 149°F). Storage Temperature: -40 to 85°C (-40 to 185°F). Protection: IP67 and IP65 (true outdoor).

Vibration: 5g @ 57 to 2000 Hz, 150 h per axis.

Shock: 30g, 11ms, 10x per axis.

Certification: e1 and CE; ISO 15003; ISO 16740-4 Climatic Loads C.

| Features by Model | A3S - Full | A3S - Basic | A6S - Full | A6S - Basic | A8S - Full | A8S - Basic |
|---|---|---|---|---|---|---|
| **Part Number** | 4000401 | 4000400 | 4000408 | 4000407 | 4002710 | 4002709 |
| **Display Size** | 4.3 inch / 109 mm | 4.3 inch / 109 mm | 7 inch / 177 mm | 7 inch / 177 mm | 12.1 inch / 307 mm | 12.1 inch / 307 mm |
| **Resolution** | 480 x 262 pixel | 480 x 262 pixel | 800 x 480 pixel | 800 x 480 pixel | 1280 x 880 pixel | 1280 x 880 pixel |
| **Backlit Keys** | 8 soft, 3 hard | 8 soft, 3 hard | 12 soft, 3 hard | 12 soft, 3 hard | 8 soft, 4 hard | 8 soft, 4 hard |
| **Touchscreen** | Yes | No | Yes | No | Yes | Yes |
| **USB Port** | Front Panel | Rear Connection | Front Panel | Rear Connection | Front Panel | Front Panel |
| **Inputs** | 4 analog / digital | none | 4 analog / digital | none | 4 analog / digital | 2 analog / digital |
| **Outputs** | 3 digital | none | 3 digital | none | 3 digital | 1 digital |
| **Video Inputs** | 1 | none | 3 | none | 3 | 1 |
| **CANbus ISO 11898** | 2 | 2 | 2 | 2 | 2 | 2 |
| **Audio - Out Interface** | No | No | Yes | No | Yes | No |
| **Processor Speed** | 532 MHz | 532 MHz | 532 MHz | 532 MHz | 1 GHz | 800 MHz |
| **RAM (DDR2)** | 256 MB | 128 MB | 128 MB | 128 MB | 1024 MB | 512 MB |
| **Mass Storage (Flash Memory)** | 1GB | 512MB | 1GB | 512MB | 8 GB | 4 GB |

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INNOVATION AND TECHNOLOGY CENTER IN VERNON HILLS, ILLINOIS.


EUROPEAN HEADQUARTERS, ENGINEERING AND MANUFACTURING FACILITY IN BIRMINGHAM, U.K.


ASIAN/PACIFIC HEADQUARTERS, PRECISION MACHINING AND MANIFOLD ASSEMBLY FACILITY IN CHANGZHOU, CHINA, NEAR SHANGHAI.

RoHS COMPLIANT HydraForce valve and manifold products comply with the European Council and Parliament RoHS directive 2002/95/EC limiting the use of hazardous substances. For all other products, consult factory.

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