CANdrive™

CANbus SAE J1939 to Electric Gauge Interface

Installation and Operating Instructions

00-02-0618
revision F, 7th January 2011
section 78

Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before installation. It is your responsibility to ensure that qualified mechanical and electrical technicians install this product. If in doubt, please contact your local Murphy representative.

General Information

WARNING

BEFORE BEGINNING INSTALLATION OF THIS PRODUCT

- ✓ Disconnect all electrical power to the machine
- ✓ Make sure the machine cannot operate during installation
- ✓ Follow all safety warnings of the machine manufacturer
- ✓ Read and follow all installation instructions

As part of the MurphyLink® family, CANdrive offers a cost effective instrument solution for modern electronic engines. CANdrive modules read engine ECU CANbus/J1939 data, drive standard electric panel gauges, and provide LED indication of status and faults.

CANdrive has three dedicated outputs for tachometer, oil pressure and coolant temperature gauges, with DIP switch-selectable compatibility for Murphy, VDO or Datcon gauges. For volume orders, the outputs can be custom-configured for other gauge types, lamps, relays or remote signalling.

CANdrive advantages include:

- the retrofitting of existing electric gauge panels to new, J1939 compatible engines
- the use of standard, economical electric gauges with new J1939 engines
- no need for installation of additional gauge senders, tachometer magnetic pickups and wiring.

CANdrive is packaged in a compact, surface mounted case with epoxy encapsulation for maximum durability and environmental sealing. Electrical connection is via a 12-way automotive type connector. Model CDV100F has a forward facing connector and one power/CAN status LED. Model CDV300R has 8 LEDs for indication of J1939-transmitted engine faults and status. All models include a 6-way DIP switch for flexible configuration.

Patent applied for GB2424280

Specifications

Power supply

Operating voltage,
12V range (switch S5 on/up): 7 to 16 VDC
24V range (switch S5 off/down): 19 to 30 VDC
Current consumption:
CDV100: 25 mA typ.
CDV300: 50 mA typ. (2 LEDs lit)

Inputs

CANbus: SAE J1939 protocol. Input has a 120 Ohm terminating resistor, removable by switch S4.

Outputs (all ratings non-reactive)

Oil pressure gauge, engine temperature gauge:
switch selectable for Murphy, VDO or Datcon gauges:
see Gauge Compatibility section for pressure/temperature verses equivalent sender resistance tables
Tachometer: pulsed DC, 119 Hz ±1% @ 1500 RPM

Physical

Electromagnetic compatibility: 2004/108/EC
Case material: polycarbonate / polyester / epoxy encapsulation
Overall dimensions (w x h x d):
68 x 92 x 22mm / 2.7 x 3.7 x 0.9 in.
(allow 50mm / 2.0 in. depth with connector)
Weight: approx 80g / 0.2 lb
Temperature:
operation: –40 to +85°C / –40 to +185°F, 70% RH
storage: –55 to +105°C / –67 to +221°F
Environmental sealing: IP60
(CDV300R: IP65 from front with optional CDVG gasket)
Vibration: 15g, 10 to 2000 Hz, 3-axis
Shock: 50g, 11 mS, 3-axis

Standard models & accessories

Stock code	Description
79.70.0001	CDV100F, CANdrive™ J1939 to gauge interface, 1 x CAN status LED, connector forward
79.70.0002	CDV300R, CANdrive™ J1939 to gauge interface, 8 x status/fault LEDs, connector rearward
78.00.0437	CDV-PW-30, 8 way wiring harness, length 30 in./760mm

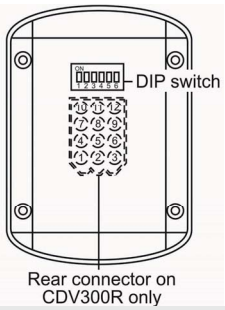
Stock code	Description
79.70.1003	CDVG, optional sealing gasket for CDV300R
78.70.0363	CDV100F plus CDV-PW-30 harness
78.70.0364	CDV300R, CDV-PW-30 and CDVG gasket
79.70.1001	CANdrive connector plug shell
79.70.1002	Connector pins for above (pack of 50)

General Information (cont.)

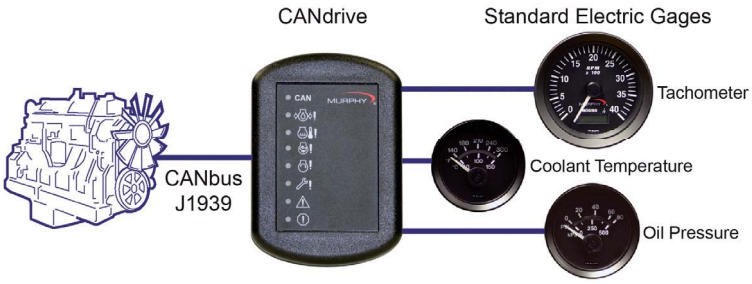
CDV100F front view

CDV300R front view

Rear view



System connection



Panel Installation

CANdrive modules are surface-mounted with 4 x no.4 screws, fixing centre dimensions as shown. Select screw length according to panel thickness, ensuring a maximum of 13mm (½ inch) screw depth into the CANdrive fixing holes.

Model CDV100F, with forward facing connector, is designed for surface mounting inside an enclosed panel. Model CDV300F, with 8 LED indicators and rearward facing connector, is designed for front-of-panel mounting: this module requires an additional 60 x 40mm (2.4 x 1.6 in.) panel cut-out for rear access to connector and switches. A CDV300F with optional gasket CDVG (fitted into a well behind the case rim) provides IP65 front-of-panel environmental sealing.

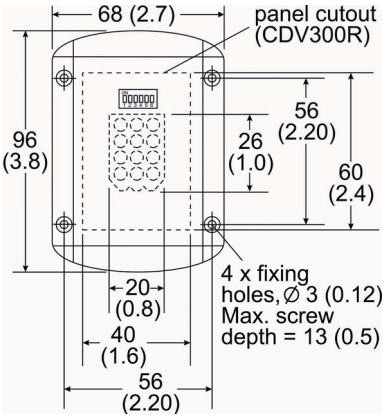
Before installing, ensure that the final mounting location meets operating temperature and environmental sealing requirements, and allows access for:

a) connection of the wiring harness

b) configuration of DIP switches S1 to S5 (location as shown above right). Alternatively, set these switches before panel fixing – see Configuration section below for full details.

Dimensions

mm (in.)



Configuration

DIP switches S1 to S5 allow OEM- or user-configuration of CANdrive operating options. Switch S6 is not used. CANdrive is supplied with all switches in the ON (up) position.

Switch settings must be made as appropriate, according to the configuration table right. Adjustment of the switch positions must be made while CANdrive is powered down.

Switch position ▲ on (up) ▼ off (down)					**Options:**
S1	S2	S3	S4	S5	
▲	▲	▲			Murphy temp. and pressure gauge
▼	▲	▲			Datcon temp. and 0 – 7 bar pressure gauges
▼	▲	▼			atcon temp. and 0 – 10 bar pressure gauges
▲	▼	▲			VDO temp. and 0 – 5 bar pressure gauges
▲	▼	▼			VDO temp. and 0 – 10 bar pressure gauges
			▲		CAN 120 Ohm terminating resistor in circuit
			▼		CAN 120 Ohm terminating resistor removed
				▲	12V DC ower supply
				▼	24V DC power supply

Pressure gauge compatibility table: pressure versus approximate equivalent sender resistance (Ohms)

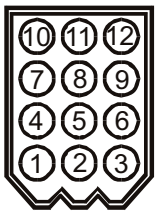
Pressure	psi	0	10	20	30	40	50	60	70	80	90	100	110	1 0	130	140
	bar	0	0.7	1.4	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.6	8.3	9.0	9.7
Murphy		240	205	171	143	123	103	88	74	60	47	33				
Datcon 0 – 7 bar		240	195	160	140	115	100	82	68	55	43	35				
Datcon 0 – 10 bar		240	215	190	168	150	135	118	107	97	87	77	67	58	50	42
VDO 0 – 5 bar		10	38	61	85	110	130	155	180							
VDO 0 –10 bar		15	30	45	60	70	81	92	103	114	125	136	148	160	170	182

Temperature gauge compatibility table: temperature versus approximate equivalent sender resistance (Ohms)

Temperature	°C	40	50	60	70	80	90	100	110	120	130	140
	°F	104	122	140	158	176	194	212	230	248	266	284
Murphy		1029	680	460	321	227	164	120	89	74	52	40
Datcon		360		160		80		50		38		
VDO		282.4	190.0	134.0	95.2	69.1	51.2	38.5	29.4	22.7	18.0	14.5

Electrical Connection

CANdrive electrical connection is via a 12-way automotive type receptacle shown right. CANdrive models are available with the connector facing forward through the front label ('F' option, e.g. model CDV100F), or rearward through the epoxy encapsulation ('R' option, e.g. model CDV300R).



An 8-way, 30"/270mm wiring harness is available as an additional loose item or as part of a CANdrive kit. For customer-made harnesses, part numbers for the mating connector plug and pins are as follows:

	Murphy part ref.	Molex part ref.
Connector plug shell x 1 (1 required per unit)	79.70.1001	03-09-1125 or 03-09-1126
Connector pins, pack of 50 (max 8 required per unit)	79.70.1002	02-09-1104

Terminal functions

Pin	Function

1 Negative DC, power supply
2 Positive DC, power supply
3 Negative DC, gauge common return

CANdrive is supplied for use with 12V (7 to 16V) DC operation. If 24V (19 to 30V) DC operation is required, push DIP switch S5 to the off (down) position.

Connect a 1 Amp anti-surge fuse in the positive DC line (pin 2).

Pins 1 and 3 are internally linked: pin 1 is typically used as a power supply connection; pin 3 is typically used as a common negative return for the gauge outputs.

4 Oil pressure gauge output
6 Coolant temperature gauge output
7 Tachometer output

Pins 4 and 6 give a variable current output for driving oil pressure and coolant temperature electric gauges. The current output versus pressure/temperature is specific to each gauge type, as selected using DIP switches S1, S2 and S3 – see Configuration section.

Pin 7 gives a square wave output (0V to battery positive DC), with a frequency proportional to engine speed. At 1500 RPM engine speed, the output frequency is 119 Hz (±1%), suitable for driving charge alternator based tachometers such as the Murphy ATA and ATHA series. Pin 7 gives no output when engine speed is below 100 RPM.

Connect each output to the appropriate gauge/tachometer signal input. Connect gauge/tachometer negative terminals to battery negative, ideally via dedicated wiring to terminal 3. (The use of dedicated return wiring to pin 3, rather than a ground/earth return, minimises gauge inaccuracies caused by ground noise.)

5 CAN Hi
8 CAN Lo

Connect these terminals to the engine CANbus, taking care to observe the correct polarity. The CANbus cable shield/screen is typically connected to ground/earth at one end only (often at the ECU): refer to the engine manufacturer's installation guidelines.

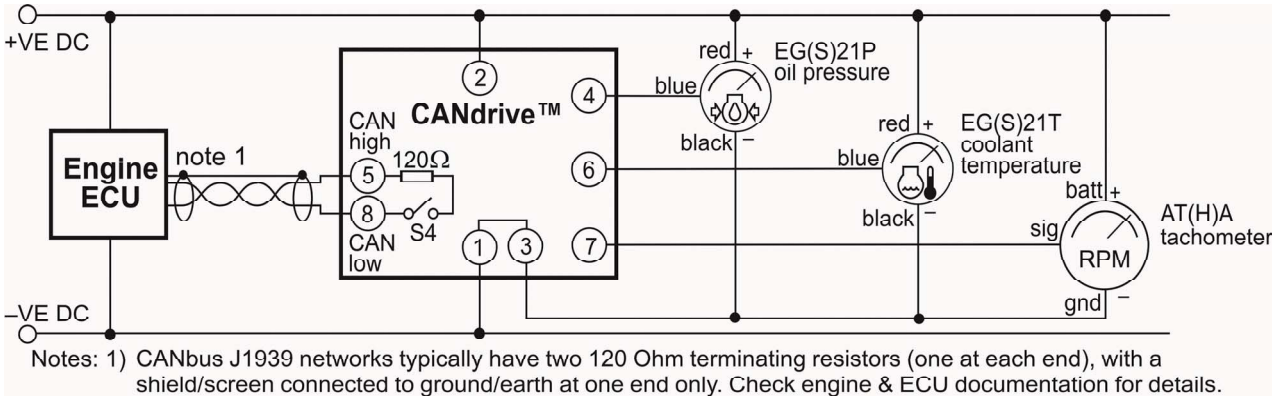
CANbus J1939 specifications require two 120 Ohm terminating resistors at each end of the network. CANdrive is supplied with a 120 Ohm network terminating resistor in circuit. If CANdrive is not positioned at the end of the CANbus network, switch out the terminating resistor by pushing DIP switch S4 off (down) – see Configuration section for details.

9 Reserved for future use
10 Factory use
11 Factory use
12 Factory use

These connections are reserved for future use, or are used in the factory setup of CANdrive. Do not connect wiring or equipment to these terminals: connection may result in permanent damage to CANdrive.

Typical Connection

Shown with Murphy EG(S) series gauges/Swichgages and AT(H)A tachometer.



Notes: 1) CANbus J1939 networks typically have two 120 Ohm terminating resistors (one at each end), with a shield/screen connected to ground/earth at one end only. Check engine & ECU documentation for details.

Operation and Maintenance

Operation

Gauge driver outputs

The gauge outputs operate when CANdrive reads valid J1939 data for engine speed, oil pressure and coolant temperature. If CANdrive stops receiving valid data, the gauge outputs are maintained at the last known value for approximately 5 seconds, after which time the outputs turn off.

Indicating LEDs

All standard models have a green CAN LED. A flashing CAN LED indicates that CANdrive is powered, but is not receiving any J1939 data. A constantly lit CAN LED indicates power on with good CANbus connection and J1939 activity. (Note: J1939 activity can originate from ANY device on the CANbus network, and may not necessarily be valid data from the engine ECU.)

Model CDV300R has additional LEDs for indication of J1939-transmitted engine faults. CANdrive responds to single DM1 (active fault code) messages that contain SPN (Suspect Parameter Number), FMI (Fault Mode Indicator) and warning/stop lamp data. CANdrive also reads multi-packet transport messages broadcast using the BAM protocol.

Typically, LEDs light continuously to indicate a shutdown fault, and flash to indicate a (non-shutdown) warning fault:

LED	Mode	Fault	J1939	
			SPN	FMI
	On	Low oil pressure shutdown	100	1
	Flashing	Low oil pressure warning	100	> 1
	On	Coolant temperature shutdown	110	0
	Flashing	Coolant temperature warning	110	> 0
	On	Overspeed shutdown	190	0
	Flashing	Overspeed warning	190	> 0
	-	Reserved for future use	-	-
	-	Reserved for future use	-	-
	Flashing	Warning fault	-	-
	Flashing	Shutdown fault	-	-

CANdrive can handle up to 8 simultaneous faults at one time: additional fault messages are not registered. When a fault becomes inactive and is no longer broadcast, the appropriate LED goes out after approximately 2 seconds.

Maintenance and Warranty

CANdrive has no user-serviceable parts. Maintenance is therefore limited to the following preventative checks:

- Check that electrical connections are secure.
- Check that the CANdrive is securely mounted, and kept free from ingress of water or build up of excessive dust/dirt. The front label and casing may be wiped with a clean, damp cloth. Do not use cleaning solvents.

CANdrive is supplied with a 2 year warranty on parts and workmanship. In the event of a fault or technical query, please contact your Murphy representative for technical support.

Further information

Document	Description
00-02-0251	EG(S)21 series electric gage installation
00-02-0258	AT series tachometer installation