SWITCHERGEAR
GEAR TO CONTROL YOUR POWER SWITCHES

Module NETCAN

Single-node daisy-chain fieldbus interface
Isolated CAN

REFERENCE MANUAL

Features

Standard module for SwitcherGear

CAN physical layer transceiver according to ISO 11898-2

Isolated fieldbus

Red and green user LEDs

User input

12-way pluggable screw terminal

Bus and power pins duplicated for daisy-chain wiring

Suggested C2000 peripherals: eCAN

Applications

Standardised fieldbus protocols: CANopen, DeviceNet, etc.

Custom control protocols

General Description

The NETCAN module is an isolated CAN transceiver interface for SwitcherGear.

Ordering Information

Order Code	***Description***
NETCAN	*SwitcherGear module, single-node daisy-chain fieldbus interface, isolated CAN.*
NET485	*SwitcherGear module, single-node daisy-chain fieldbus interface, isolated RS-485.*
NET232	*SwitcherGear module, single-node daisy-chain fieldbus interface, isolated RS-232.*
NETETH	*SwitcherGear module, single-port Ethernet interface.*

Module Quick Start

1. **Set the configurable features.**

   Determine the feature settings that are required for the system under control. If necessary, change the default solder jumper settings. Refer to the Configuration section.

2. **Review the allocation of the MCU interface signals.**

   Confirm that the MCU interface signals connect to appropriate pins on the host MCU. Refer to your SwitcherGear configuration document and Table 3.

3. **Insert into the base slot.**

   Refer to your SwitcherGear configuration document for the location of modules.

4. **Connect the external wiring to the system connector.**

   Refer to Table 1 for the pin-out of the system connector.

Standard Interfaces

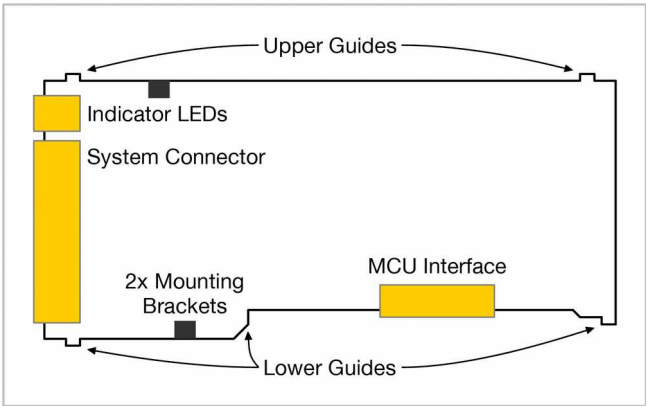

Figure 1: Parts of a SwitcherGear module.

System Connector

A 12-way pluggable terminal strip connector is used to connect system wiring to the NETCAN module.

Table 1 shows the pin-out of this connector. The connector features duplicated CAN bus connections on pins 6 to 10 to enable simple daisy-chain wiring.

The connector can be keyed by inserting the supplied red coding keys into the slots on the header. The corresponding moulded key on the plug must be removed to allow insertion into the header.

Indicator LEDs

Eight miniature indicator LEDs on the front panel show the status of the module. Refer to Table 2 for details.

Table 1: System connector. The highlighted rows indicate a duplicate set of connections to facilitate daisy-chain wiring.

Pin	Signal	Description
1 (Top)	CANH	CANH bus signal.
2	CANL	CANL bus signal.
3	VDC	Feed-through connection for daisy-chain power. Not connected to internal circuitry.
4	COM	0V for isolated transceiver circuitry and feed-through connection for daisy-chain power.
5	FIELDGND	External field ground.
6	CANH	CANH bus signal.
7	CANL	CANL bus signal.
8	VDC	Feed-through connection for daisy-chain power. Not connected to internal circuitry.
9	COM	0V for isolated transceiver circuitry and feed-through connection for daisy-chain power.
10	FIELDGND	External field ground.
11	USERn	User input. Leave open circuit, or connect to pin 12.
12 (Bottom)	COM	

Table 2: Indicator LEDs

Appearance	Left Column		Right Column	
	Colour	Description	Colour	Description
🟢 🟢	Green	Transmit active	Green	Receive active
🟢 🔴	Green	Green user LED	Red	Red user LED
⚪ ⚪	-	-	-	-
🟢 🔴	Green	Internal isolated power supply	Red	USER pin active

Table 3: MCU interface

Pin	Signal	Description
D0	CANTX	CANTX input from CAN controller. Dominant-low.
D1	CANRX	CANRX output to CAN controller. Dominant-low.
D2	-	-
D3	LEDGRN	Input for green user LED. Active-high.
D4	LEDRED	Input for red user LED. Active-high.
D5	USERn	User output. Logic high when front panel connector pin 11 is open circuit. Logic low when pin 11 is connected to pin 12.
D6	ADDR0	Address bit 0 output.
D7	ADDR1	Address bit 1 output.
D8	ADDR2	Address bit 2 output.
D9	ADDR3	Address bit 3 output.
D10	-	-
D11	-	-
A0	-	-
A1	-	-
A2	-	-
A3	-	-

MCU interface

Refer to Table 3 for details of the digital and analogue signals provided by the NETCAN module.

Refer to the SwitcherGear configuration document for your specific SwitcherGear unit for information on the mapping of the module signals to the host microcontroller on the base board.

Configuration

Address

The state of the ADDRx outputs of the module-base interface is controlled by the solder jumpers as shown in Table 4.

Table 4: Configuration of ADDRx bit logic state

ADDRx Bit Logic State	ADDRx Jumper
0 (default)	Open
1	Short

Solder Jumpers

Modules are supplied with all solder jumpers in the open state. These default feature settings are highlighted in grey in the configuration tables.

If a different configuration is required for your application, you must change the solder jumper settings before using the SwitcherGear.

Solder jumpers allow configuration of SwitcherGear modules. They function like a switch to control the features of the module. Jumpers consist of two adjacent pads on the rear side of the module circuit board. The jumper can be shorted (switch closed) by making a solder bridge across the pads. The jumper can be opened (switch open) by removing the solder bridge.

The solder jumpers are intended for one-time-only configuration. No warranty is provided for damage to solder jumpers. Only skilled personnel who are trained in correct soldering technique should undertake the configuration of the solder jumpers. Incorrect technique or excessive temperature can result in the pads of the solder jumper detaching from the circuit board, rendering the jumper permanently open-circuit.

Observe the following precautions when configuring solder jumpers:

- Anti-static handling procedures.
- Turn off power before removing or inserting modules.
- Use a fine-tip soldering iron with adjustable temperature.
- Use only lead free solder and compatible tools.
- Use the minimum temperature required to perform the task.
- Do not heat the jumper for more than 5 seconds. Allow to cool before re-applying heat.
- To remove solder from a jumper, use a narrow (e.g. 1.5 mm) fluxed solder wicking braid.

Functional Description

User LEDs

There are two LEDs on the front panel indicator that can be used for your application, one red LED and one green LED.

For applications that implement CANopen, the user LEDs can be used to implement the ERR LED and RUN LED defined in the CANopen indicator specification (CAN in Automation document 303-3).

Address Bits

The address bits, ADDR3 to ADDR0, can be used to associate a network address with the NETCAN module. The signals can be read by the microcontroller and used to configure the network identity and/or behaviour of the CAN interface depending on the network address. Their use is optional and not required for CAN bus operation.

The user is free to use as many of the ADDR signals as required for the application. The four ADDR signals allow up to 16 unique addresses to be specified.

For example, consider a system with four SwitcherGear units with identical module-to-host routing and firmware. One is intended to be a system master and the others slaves 1, 2 and 3. Address bits ADDR1 and ADDR0 should be configured in each unit to be a unique address. On power up, the firmware can read the ADDR/0 bits and configure the functionality for master or slave operation. The three slaves can also be distinguished by the master by their unique identity address.

User Input

The user input is a general purpose input. Its use is optional and not required for CAN bus operation.

It can be used in the same way as the address bits to assign a network address. The difference is that the signal is controlled by external wiring rather than solder jumpers. This means that the CAN identity or behaviour is not fixed to the SwitcherGear unit, but is set by the wiring harness that is plugged into the NETCAN module.

Isolation

The signals of the front panel connector are isolated from the SwitcherGear. The isolation is intended for functional isolation of ground loops and not for protection against connection to live circuits.

The power for the isolated circuitry is generated internally and not from VDC on the front panel connector.

It is recommended to connect the 0V pin(s) on the front panel connector to 0V of the CAN interface of other CAN devices in the network. This should be done even if there is no bus power used in the network. Doing so references all CAN interfaces to the same potential and improves common mode performance.

Applications Information

Daisy-Chain Wiring

CAN bus is intended to be used in networks with more than two devices on the network. The physical structure of the CAN network can be of any type (e.g. star, linear, etc.) as long as certain requirements for termination are met.

A linear network structure is commonly used for CAN. In this structure, the network devices are situated along a single, linear bus. This structure can be realised in one of two ways:

- A main linear bus with short spurs connecting the device to the bus. This is not commonly used because it requires stubs to be tapped into the main bus.
- Daisy chain wiring. This is commonly used because the bus wiring is made from simple segments from one device to the next.

The NETCAN module provides a duplicate set of CAN bus connections on the front panel connector. The CANH, CANL, VDC and 0V pins are connected internally to the other pin of the same name. This allows the CAN signals and power to be fed through the NETCAN module for simple daisy-chain wiring.

Figure 2 shows how CAN devices can be daisy-chained. The CAN devices are shown with duplicated CAN connections and feed-through wiring for daisy-chain wiring.

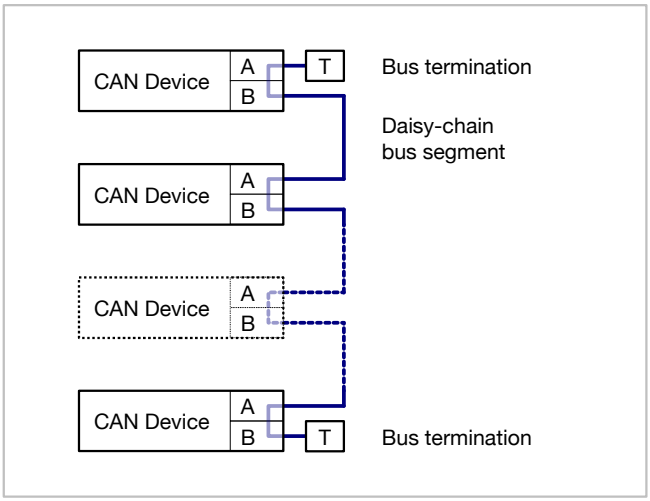

Figure 2: Daisy-chaining and termination of CAN devices in a linear bus structure.

The VDC pins on the front panel connector are provided only for feeding through power in daisy-chain wired networks. VDC is not used by the NETCAN module.

Termination

A linear CAN network should be terminated at the two ends of the bus. They are required to prevent reflections on the bus and set the correct signals levels. The value of the termination resistors should be equal to the characteristic impedance of the cable used to wire the CANH and CANL signals, which is typically 120 Ω.

On the NETCAN module, the termination resistor can be wired into the unused CANH/CANL terminals. Take precautions to ensure that bare wires on the termination resistor cannot short to other circuits.

External Wiring

The wiring of the CANH and CANL signals should use twisted pair conductors with a shield. The characteristic impedance should be 120 Ω. Cables designed specifically for CAN are available from various manufacturers. Many cables also provide two extra conductors for bus power.

The pluggable terminal strip can accept bare conductors with cross sectional area in the range 0.15 mm^2 to 1.5 mm^2. The acceptable range for conductors terminated with bootlace ferrules is 0.25 mm^2 to 0.5 mm^2.

Host MCU

Texas Instruments C2000

Texas Instruments C2000 microcontrollers have an enhanced CAN controller, eCAN. Refer to manufacture documentation on use of the eCAN peripheral.

Warnings

Use shielded cable for wiring to external devices.

The length of cables connected to the module front panel connector must not be longer than 30 m.

The user is responsible to ensure that the cables and connectors used for external wiring have insulation and/or separation distances that provide isolation from live parts and from earth.

The user is responsible to ensure that cables and connectors used for external wiring that carry live voltages have insulation and/or separation distances that provide protection against indirect contact.

The user is responsible to ensure that the installation provides protection against direct contact.

Electrical Characteristics

The following specifications apply for V_{DC} = 24 V, T_A = 25 °C, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Unit
CAN INTERFACE					
Driver differential output voltage	R_L = 60 Ω				
Dominant		1.5		3.0	V
Recessive		–0.12		0.12	V
Receiver threshold voltage					
Dominant			0.75	0.90	V
Recessive		0.50	0.65		V
Hysteresis			0.15		V
Differential resistance		30		80	kΩ
Common-mode transient immunity		25	50		kV/µs
DAISY-CHAIN					
Supply feed-through current	0V, VDC			2	A
Bus feed-through current limit	CANH, CANL	1.0			A
Bus feed-through series resistance	CANH, CANL		0.4	0.8	Ω
AUXILIARY INPUT					
Low-level input current	Input voltage 0 V			–10	mA
Response time				10	µs

Revision History

Revision	Date	Changes From Previous Release
1	16 Apr 2014	▪ Original release.
2	17 Oct 2014	▪ Updated naming and format.
3	27 Jun 2018	▪ Updated naming.