Control Modes
- Stand-alone: Pulse/Direction, CU/CD
- Indexer, Point-to-Point, PVT
- Master encoder (Gearing/Camming)
- Distributed driver (CANopen, DeviceNet)
- Position, velocity, torque (Servo Mode)

Command Interface
- Step/Direction or CW/CCW inputs
- CANopen/DeviceNet
- ASCII and discrete I/O
- ±10 Vdc velocity/torque (Servo Mode)
- PWM velocity/torque (Servo Mode)
- Digital inputs for indexer control

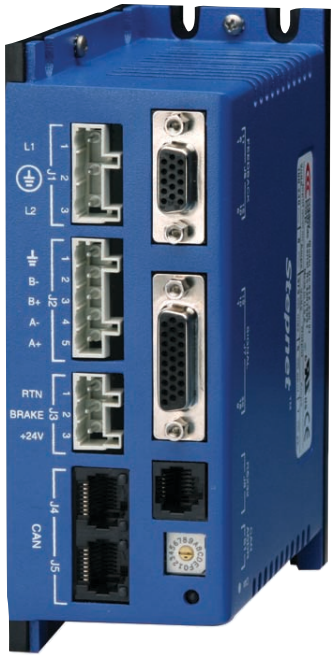
Communications
- CANopen/DeviceNet
- RS232

Feedback
- Digital Quad A/B encoder
  Differential or single-ended
- Secondary encoder / buffered encoder out

I/O - Digital
- 12 inputs, 4 outputs
  Two high-speed inputs configurable as differential or single-ended

Regen
- Internal

Dimensions: mm [in]
- 146 x 119 x 55 [5.73 x 4.7 x 2.17]



Model	Vac	Ic	Ip
STX-115-07	100~120	5	7
STX-230-07	100~240	5	7

Add "-H" to part number for factory-installed heatsink

DESCRIPTION

Stepnet AC is a compact, AC powered microstepping drive for control of hybrid stepping motors. It operates as a stand-alone driver taking Pulse/Direction or CW/CCW inputs from an external controller or as a distributed drive on a CANopen or DeviceNet control network. In Servo mode a stepper with encoder operates as a brushless servo motor in position, velocity, or torque modes.

Indexing mode simplifies operation with PLC's that use outputs to select and launch indexes and inputs to read back drive status. A single serial port on the PLC can send ASCII data to multiple drives to change motion profiles as machine requirements change. DeviceNet capability enables multiple Stepnet AC drives to be controlled from Allen-Bradley PLC's.

CAN bus operation supports Profile Position, Profile Velocity, Profile Torque, Interpolated Position, and Homing. Up to 127 Stepnet AC drives can operate on a single CAN bus and groups of drives can be linked via the CAN so that they execute motion profiles together.

Input command signals include ±10 Vdc (torque, velocity, in Servo Mode), PWM/Polarity (torque, velocity in Servo Mode), or Step/Direction and CU/CD (microstepping).

Separate ports are provided for differential or single-ended encoder connections. The active input is programmable.
Twelve digital inputs include a dedicated drive Enable, motor overtemp switch, and 10 general purpose inputs. Two of the high-speed inputs are programmable as differential or single-ended.

GENERAL SPECIFICATIONS

Test conditions: Load (per bi-polar phase) = 2 mH + 1 Ω line-line. Ambient temperature = 25°C, +HV = HV_{max}

MODEL	STX-115-07	STX-230-07	
OUTPUT POWER			
Peak Current	7 (5)	7 (5)	Adc (Arms, sinusoidal), ±5% (Note 2)
Peak time	1	1	Sec
Continuous current	5 (3.54)	5 (3.54)	Adc (Arms, sinusoidal), ±5% (Note 1)
INPUT POWER			
Mains Voltage	100~120	100~240	Vac, 1 Ø, 50~60 Hz
Mains current		8	Arms, continuous
+24 Vdc Control Power		+20 to +32 Vdc @ 500 mAdc maximum	Required for operation
PWM OUTPUTS			
Type	Dual H-bridge MOSFET inverters, 15 kHz center-weighted PWM, space-vector modulation		
PWM ripple frequency	30 kHz		
Minimum inductance	200 µH per phase		
REGENERATION			
Type	Internal MOSFET dissipator		
Power dissipation	80 W peak, 40 W continuous		
Cut-In Voltage	HV > 195 Vdc	HV > 390 Vdc	Regen MOSFET's are on
Drop-Out Voltage	HV > 190 Vdc	+HV < 380 Vdc	Regen MOSFET's are off
Tolerance	±2 Vdc		For either Cut-In or Drop-Out voltage

DIGITAL CONTROL		
Digital Control Loops	Current, velocity, position. 100% digital loop control	
	Dual loop position control using secondary encoder input	
Sampling rate (time)	Current loop: 15 kHz (66.7 us) Velocity, position loops: 3 kHz (333 us)	
Commutation	Sinusoidal field-oriented control	
Bandwidth	Current loop: 2.5 kHz typical, bandwidth will vary with tuning & load inductance	
HV Compensation	Changes in bus voltage do not affect bandwidth	
Minimum load inductance	200 µH per phase	
COMMAND INPUTS		
CAN	CANopen: Profile Position, Interpolated Position, Homing,	
	Profile Torque, Profile Velocity	
DeviceNet	Explicit messaging object supported, UCMM (Unconnected Message Manager) protocol	
ASCII	Single RS-232 connection passes messages to multiple drives via CAN link drive-drive	
Digital position reference	Step/Direction or CW/CCW	Stepper commands (1.5 MHz maximum rate)
	Quad A/B Encoder	20 Mcount/sec after quadrature (5 Mline/sec)
Indexing	Index address, index-start, priority-index start	
Camming	Inputs for master encoder, cam start, cam table address	
Servo mode operation supports the following command inputs:		
Digital torque & velocity	PWM/Polarity	PWM = 0~100%, Polarity = 1/0
	PWM/50%	PWM = 50% ±50%, no polarity signal required
	PWM frequency range	1 kHz minimum, 100 kHz maximum
	PWM minimum pulse width	220 ns
Analog torque, velocity	±10 Vdc, 5 kΩ differential input impedance, 12-bit resolution	
DIGITAL INPUTS		
Number	12: 11 programmable, 1 input dedicated to drive Enable function, 1 for motor temperature switch	
Type	6 General-purpose (GP), 5 high-speed single-ended (HS), 1 motemp (GP)	
	4 HS inputs configurable at four single-ended or two differential	
GP [IN1,2,3,4,10,11]	74HC14 Schmitt trigger operating from 5.0 Vdc with 330 µs RC filter on input,	
	10 kΩ to +5 Vdc or ground (programmable), Vin-LO < 1.35 Vdc, Vin-HI >3.65 Vdc, +24 Vdc max	
HS [IN5]	74HC14 Schmitt trigger operating from 5.0 Vdc with 100 ns RC filter on input,	
	10 kΩ to +5 Vdc, Vin-LO < 1.35 Vdc, Vin-HI >3.65 Vdc, +12 Vdc max	
HS [IN6,7,8,9]	RS-422 line receiver with 100 ns RC filter on input, Vin-LO < 2.30 Vdc, Vin-HI > 2.45 Vdc, +12 Vdc max	
	1.5 MHz maximum pulse frequency for HS inputs when driven by active (not open-collector) sources	
	Configurable as 2 differential inputs: [IN8+] & [IN6-], and [IN9+] and [IN7-]	
GP [IN12]	74HC14 Schmitt trigger operating from 5.0 Vdc with 33 µs RC filter on input, +24 Vdc max	
	4.99 kΩ to +5 Vdc, Vin-LO < 1.35 Vdc, Vin-HI >3.65 Vdc, +24 Vdc max, for motor over-temp sensor	
Pull-up, pull-down control	GP & HS inputs are divided into four groups with selectable connection of input pull-up/down resistor	
	to +5 Vdc or ground for each group: [IN1,2,3], [IN4], [IN5,6,7], [IN8,9,10,11]	
	[IN12] pulls-up to +5 Vdc with no selection for pull-down to ground	
DIGITAL OUTPUTS		
Number	4	
[OUT1], [OUT2], [OUT3]	Current-sinking MOSFET with 1 kΩ pull-up to +5 Vdc through diode	
Ratings	1 Adc max for total current (outputs 1~3), +30 Vdc max	
	External flyback diode required if driving inductive loads	
Brake [OUT4]	Opto-isolated, current-sinking MOSFET with flyback diode to +24 Vdc, 1 Adc max	

Notes:

1) Mounting to a heatsink is required for operation at continuous current.
2) Current ratings are for current vector produced by currents flowing in A and B phases (90º phase difference between phases)

MULTI-MODE ENCODER PORT

As Secondary Encoder Input	Digital quadrature encoder (A, /A, B, /B, X, /X), 121 Ω terminating resistors across complementary inputs 20 M counts/sec, post-quadrature (5 M lines/sec)
As Emulated Encoder Output	Quadrature encoder emulation with programmable resolution to 4096 lines (65,536 counts) per cycle from analog sin/cos encoders. 18 M counts/sec, post-quadrature (4.5 M lines/sec)
As Buffered Encoder Output	Buffered signals from digital quad A/B/X feedback encoder. 20 M counts/sec, post-quadrature (5 M lines/sec) A, /A, B, /B, X, /X, signals from 26LS31 differential line driver

RS-232 PORT

Mode	Full-duplex, DTE serial communication port for drive setup and control; 9,600 to 115,200 Baud
Signals	RxD, TxD, Gnd
Protocol	Binary or ASCII formats
Multi-Drop	ASCII communications to multiple Copley drives via a single RS-232 port: RS-232 to first Drive_0, then daisy-chain to Drive_1~Drive_N via CAN

CAN PORTS

Format	CAN V2.0b physical layer for high-speed connections compliant
Data	CANopen Device Profile DSP-402
Signals	CANH, CANL, Gnd, pass-through for CAN_V+
Isolation	CAN interface circuit and +5 Vdc supply are optically isolated from drive circuits
Address selection	Selectable by switch, logic inputs or programmable in flash memory

MOTOR CONNECTIONS

Power	Phases A, /A, B, /B for bi-polar stepper motor
Feedback	Digital quadrature A/B/(X) encoders with differential or single-ended outputs Two ports (differential or single-ended) and are provided with programmable selection of active port. Differential: 26C32 line-receivers with 22 ns RC filters Single-ended: 74HC2G14 Schmitt triggers with 100 ns RC filter and 2.2 kΩ pull-ups to +5 Vdc
Brake	Digital output, isolated, 1 Adc, +30 Vdc max, programmable, with flyback diode to +24 Vdc
Overtemp sensor	Digital input, non-isolated, 4.99 kΩ pull-up to +5 Vdc, programmable
Encoder 5V power	+5 Vdc @ 250 mA max (on J6-2, J6-4, and J7-20; total current to all pins cannot be >250 mA)

LED INDICATORS

Drive Status	Bicolor LED, drive status indicated by color, and blinking or non-blinking condition
CAN Status	Bicolor LED, status of CAN bus indicated by color and blink codes to CAN Indicator Specification 303-3

PROTECTIONS

HV Overvoltage	+HV > 200 Vdc (STX-115-07) or 400 Vdc (STX-230-07)	Drive PWM outputs disabled
HV Undervoltage	+HV < 60 Vdc	Drive PWM outputs disabled
Drive over temperature	Heatplate > 70 °C ±3 °C	Drive PWM outputs disabled
Short circuits	Output to output (A to /A, B to /B), output to ground, internal PWM bridge faults	
I2T Current limiting	Programmable: Current foldback to continuous limit when I2T threshold is exceeded	
Motor over temperature	Drive PWM outputs disabled when [IN12] is active (programmable)	
Feedback power loss	Fault occurs if feedback +5 Vdc output is < 85% of nominal value	

MECHANICAL & ENVIRONMENTAL

Size	146 x 119 x 55 [5.73 x 4.7 x 2.17]
Weight	0.67 lb (0.30 kg)
Ambient Temperature, Operating	0 to 45 °C
Ambient Temperature, Storage	-40 to +85 °C
Vibration	2 g peak, 10~500 Hz (sine), IEC60068-2-6
Shock	10 g, 10 ms, half-sine pulse, IEC60068-2-27
Humidity	0 to 95%, non-condensing
Contaminants	Pollution degree 2
Environment	IEC68-2:1990

AGENCY STANDARDS CONFORMANCE

EN 55011 : 2007	CISPR 11 : 2003/A2 : 2006 Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment
EN 61000-6-1 : 2007	Electromagnetic Compatibility Generic Immunity Requirements

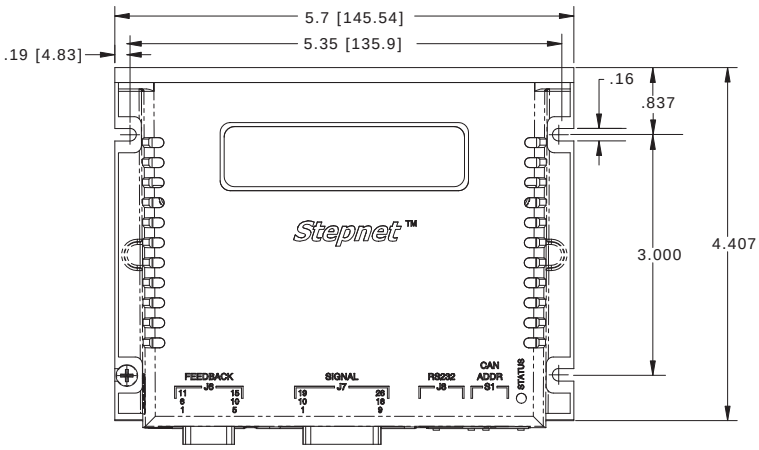
Following the provisions of EC Directive 2004/108/EC (EMC Directive)

EN 61010-1 : 2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use

Following the provisions of EC Directive 2006/95/EC (Low Voltage Directive)

UL 508C 3rd Ed.: 2002	UL Standard for Safety for Power Conversion Equipment
UL 61010-1 2nd Ed.: 2004	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

DIMENSIONS



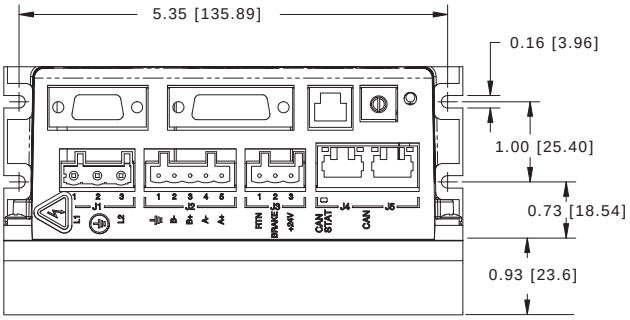
Notes

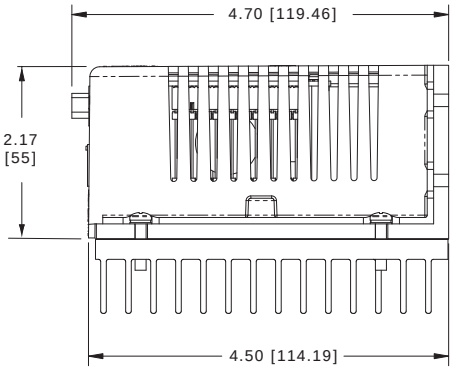
1. Dimensions shown in inches [mm].
2. Use external tooth lockwashers between mounting screw head and drive chassis for safety and CE compliance. Recommended screws are #6-32 (M3.5) torqued to 8~10 lb·in (0.79~1.02 N·m).

Weights:

Drive: 0.67 lb (0.30 kg)

Heatsink: 0.56 lb (0.25 kg)





COMMUNICATIONS

CME 2 SOFTWARE

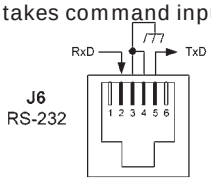
Drive setup is fast and easy using *CME 2* software. All of the operations needed to configure the drive are accessible through this powerful and intuitive program. Connections are made once and *CME 2* does the rest thereafter. Encoder wire swapping to establish the direction of positive motion is eliminated.

Motor data can be saved as .ccm files. Drive data is saved as .ccx files that contain all drive settings plus motor data. This eases system management as files can be cross-referenced to drives. Once a drive configuration has been completed systems can be replicated easily with the same setup and performance.

RS-232 COMMUNICATION

Stepnet AC is configured via a three-wire, full-duplex RS-232 port that operates from 9,600 to 115,200 Baud. *CME 2* software communicates with the drive over this link for commissioning and adjustments.

When operating as a stand-alone drive that takes command inputs from an external controller, *CME 2* is used for configuration. When operated as a CAN node, *CME 2* is used for programming before and after installation in a CAN network. *Stepnet AC* can also be controlled via *CME 2* while it is in place as a CAN node. During this process, drive operation as a CAN node is suspended. When adjustments are complete, *CME 2* relinquishes control of the drive and returns it to the CAN node state. Multiple drives can communicate over a single RS-232 port by daisy-chaining the master drive to other drives using CAN cables. The master drive does the RS-232 communication with the system and echoes the commands to the other drives over the CAN bus.



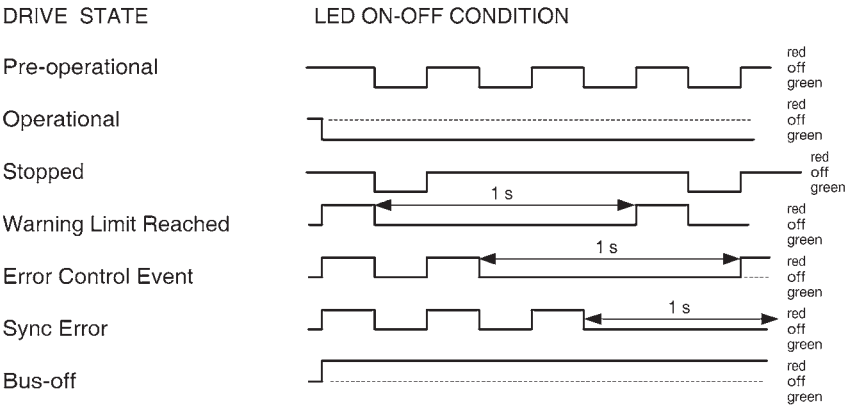
CANOPEN NETWORKING

Based on the CAN V2.0b physical layer, a robust, two-wire communication bus originally designed for automotive use where low-cost and noise-immunity are essential, CANopen adds support for motion-control devices and command synchronization. The result is a highly effective combination of data-rate and low cost for multi-axis motion control systems. Device synchronization enables multiple axes to coordinate moves as if they were driven from a single control card.

CANOPEN COMMUNICATION

Stepnet AC uses the CAN physical layer signals CANH, CANL, and GND for connection, and CANopen protocol for communication. The default address is 0 which set via the rotary switch, and a flash address of 0. Before installing the drive in a CAN system, it must be assigned a non-zero CAN address. A maximum of 127 CAN nodes are allowed on a single CAN bus. For installations with sixteen or more CAN nodes on a network CME 2 can be used to configure *Stepnet AC* to use a combination of the rotary switch, digital inputs and programmed offset in flash memory to configure the drive with a CAN node address.

CAN STATUS LED



Drive Fault conditions:

- Over or under-voltage
- Motor over-temperature
- Encoder +5 Vdc fault
- Short-circuits from output to output
- Short-circuits from output to ground
- Internal short circuits
- Drive over-temperature

Faults are programmable to be either transient or latching

Note: Red & green led on-times do not overlap.
LED color may be red, green, off, or flashing of either color.

DRIVE STATUS LED

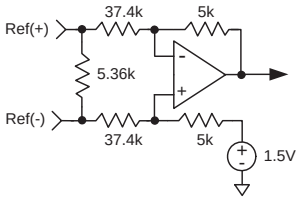
A single bi-color LED gives the state of the drive by changing color, and either blinking or remaining solid.
The possible color and blink combinations are:

- *Green/Solid:* *Drive OK and enabled. Will run in response to reference inputs or CANopen commands.*
- *Green/Slow-Blinking:* *Drive OK but NOT-enabled. Will run when enabled.*
- *Green/Fast-Blinking:* *Positive or Negative limit switch active. Drive will only move in direction not inhibited by limit switch.*
- *Red/Solid:* *Transient fault condition. Drive will resume operation when fault is removed.*
- *Red/Blinking:* *Latching fault. Operation will not resume until drive is Reset*
- *Red/Blinking:* *Internal DSP failure*

COMMAND INPUTS

ANALOG TORQUE, VELOCITY, POSITION

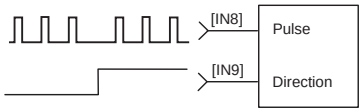
A single ±10 Vdc differential input connects to controllers that use PID or similar compensators, and output a current or velocity command to the drive. Drive output current or velocity vs. reference input voltage is programmable. In position-mode, the analog command is converted to a digital position reference based on a programmable ratio of encoder counts vs. input volts. When this is greater than the deadband, which is programmable down to 0 V, it is passed through velocity, acceleration, and deceleration limiters after which it becomes the input to the position loop.



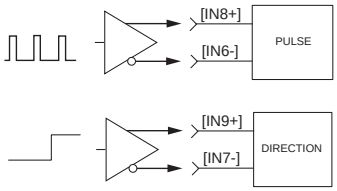
DIGITAL POSITION

Digital position commands can be in either single-ended or differential format. Single-ended signals should be sourced from devices with active pull-up and pull-down to take advantage of the high-speed inputs. Differential inputs have 121 Ω line-terminators.

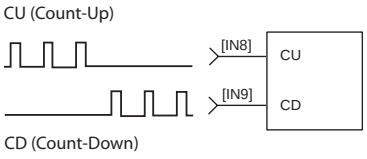
SINGLE-ENDED PULSE & DIRECTION



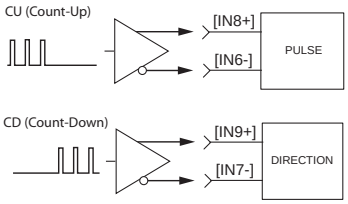
DIFFERENTIAL PULSE & DIRECTION



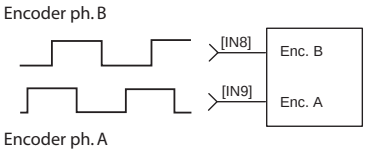
SINGLE-ENDED CU/CD



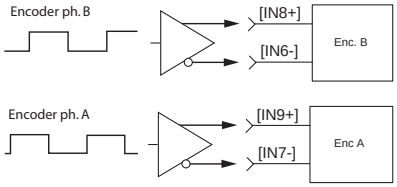
DIFFERENTIAL CU/CD



QUAD A/B ENCODER SINGLE-ENDED



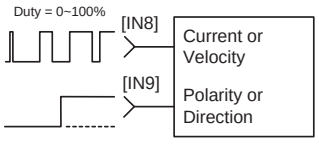
QUAD A/B ENCODER DIFFERENTIAL



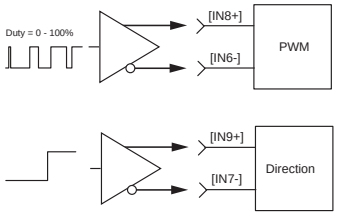
DIGITAL TORQUE, VELOCITY

Digital torque or velocity commands can be in either single-ended or differential format. Single-ended signals must be sourced from devices with active pull-up and pull-down to take advantage of the high-speed inputs.

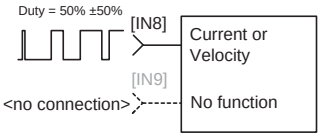
SINGLE-ENDED PWM & DIRECTION



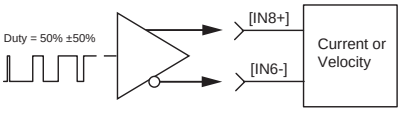
DIFFERENTIAL PWM & DIRECTION



SINGLE-ENDED 50% PWM



DIFFERENTIAL 50% PWM

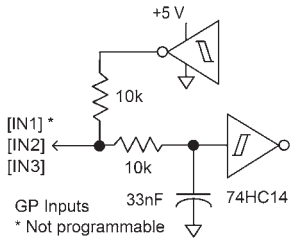


GP (GENERAL PURPOSE) DIGITAL INPUTS

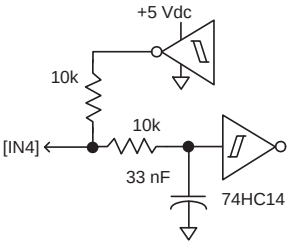
There are twelve digital inputs, eleven of which have programmable functions. Input [IN1] is not programmable and is dedicated to the drive Enable function. This is done to prevent accidental programming of the input in such a way that the controller could not shut it down. Programmable functions of the digital inputs include:

- Amp Enable
- Drive Reset
- Motion profile abort
- CAN address bits
- Indexer control: index address, index start, priority index start
- Positive Limit switch
- Motor overtemperature
- Analog Input ÷ 8
- Cam-table trigger
- Negative Limit switch
- Home switch
- PWM Sync

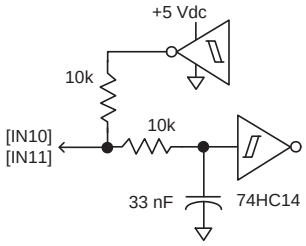
24 Vdc max



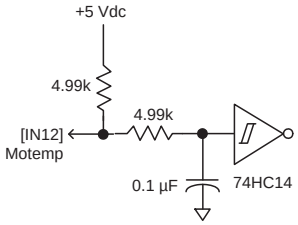
24 Vdc max



24 Vdc max



24 Vdc max

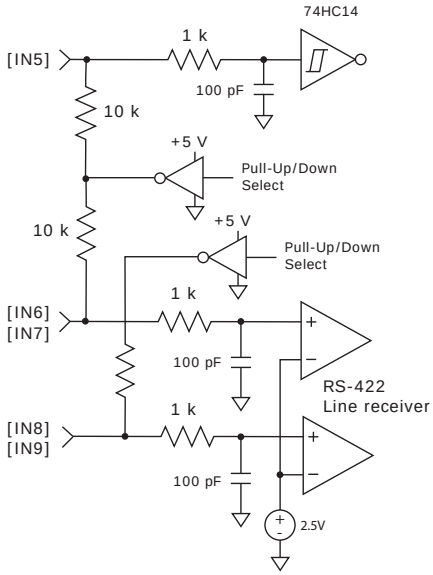


HS (HIGH SPEED) DIGITAL INPUTS

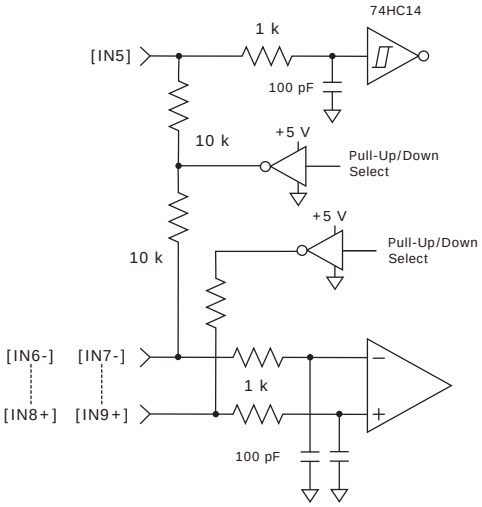
These inputs have all the programmable functions of the GP inputs plus these additional functions on [IN8] & [IN9] which can be configured as single-ended or differential:

- PWM 50%, PWM & Direction for Velocity or Current modes
- Pulse/Direction, CU/CD, or A/B Quad encoder inputs for Position or Camming modes

SINGLE-ENDED
12 Vdc max



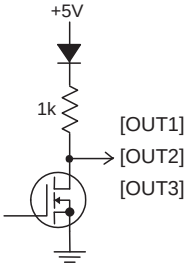
DIFFERENTIAL
12 Vdc max



DIGITAL OUTPUTS

The digital outputs are open-drain MOSFETs with 1 kΩ pull-up resistors in series with a diode to +5 Vdc. They can sink up to 250 mAdc from external loads operating from power supplies to +30 Vdc. The output functions are programmable. The active state of the outputs is programmable to be on or off.

When driving inductive loads such as a relay, an external fly-back diode is required. The internal diode in the output is for driving PLC inputs that are opto-isolated and connected to +24 Vdc. The diode prevents conduction from +24 Vdc through the 1 kΩ resistor to +5 Vdc in the drive. This could turn the PLC input on, giving a false indication of the drive output state.

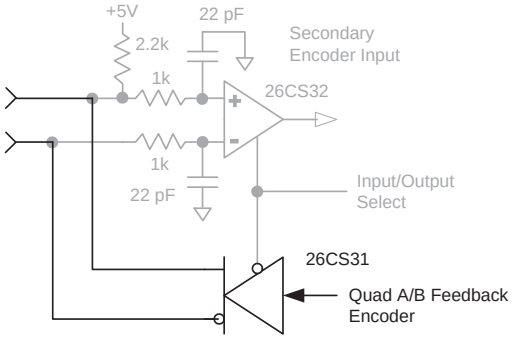


MULTI-MODE ENCODER PORT

This port consists of three differential input/output channels that take their functions from the Basic Setup of the drive.
On drives with quad A/B encoder feedback, the port works as an output buffering the signals from the encoder. With resolver or sin/cos encoder versions, the feedback is converted to quad A/B signals with programmable resolution. These signals can then be fed back to an external motion controller that closes the position or velocity loops. As an input, the port can take quad A/B signals to produce a dual-loop position control system or use the signals as master-encoder feedback in camming mode. In addition, the port can take stepper command signals (CU/CD or Pulse/Direction) in differential format.

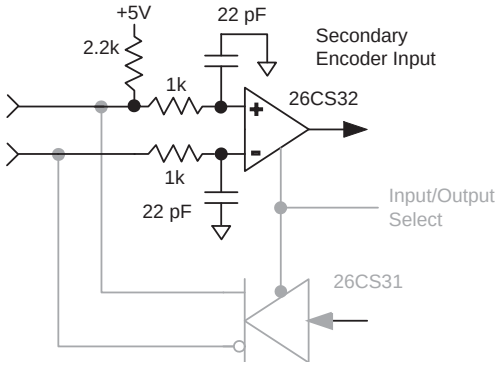
AS BUFFERED OUTPUTS FROM A DIGITAL QUADRATURE FEEDBACK ENCODER

When using a digital quadrature feedback encoder, the A/B/X signals drive the multi-mode port output buffers directly. This is useful in systems that use external controllers that also need the motor feedback encoder signals because these now come from J7, the Control connector. In addition to eliminating "Y" cabling where the motor feedback cable has to split to connect to both controller and motor, the buffered outputs reduce loading on the feedback cable that could occur if the motor encoder had to drive two differential inputs in parallel, each with it's own 121 ohm terminating resistor.



AS A MASTER OR CAMMING ENCODER INPUT FROM A DIGITAL QUADRATURE ENCODER

When operating in position mode the multi-mode port can accept digital command signals from external encoders. These can be used to drive cam tables, or as master-encoder signals when operating in a master/slave configuration.



AS DIGITAL COMMAND INPUTS IN PULSE/DIRECTION, PULSE-UP/PULSE-DOWN, OR DIGITAL QUADRATURE ENCODER FORMAT

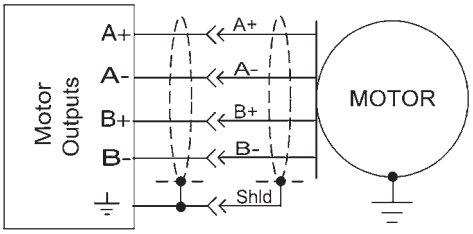
The multi-mode port can also be used when digital command signals are in a differential format. These are the signals that typically go to [IN9] and [IN10] when they are single-ended. But, at higher frequencies these are likely to be differential signals in which case the multi-mode port can be used.

MOTOR CONNECTIONS

The only motor connections required for stepper operation are the motor phases. These carry the driver output currents that drive the motor to produce motion. The feedback encoder, brake, and motor over-temperature sensors are optional. If stall-detection is desired in stepper operation the encoder is required. When operating a stepper as a servo-motor the encoder is also required.

MOTOR PHASE CONNECTIONS

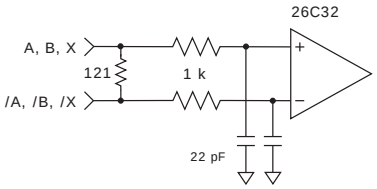
The driver output is a dual H-bridge that converts the DC buss voltage (+HV) into sinusoidal voltage waveforms that drive the motor phases. Cable should be sized for the continuous current rating of the driver. Motor cabling should use twisted, shielded conductors for CE compliance, and to minimize PWM noise coupling into other circuits.



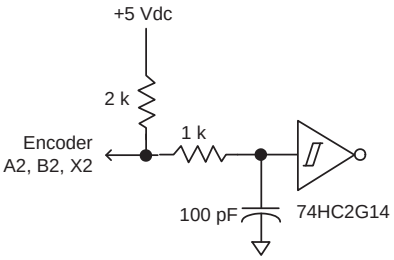
MOTOR ENCODER

Separate inputs are provided for differential and single-ended digital encoders and the active input is programmable. Encoders are optional and may be used to check for motor stalling in microstepping mode, or for operation in servo mode.

DIFFERENTIAL ENCODER

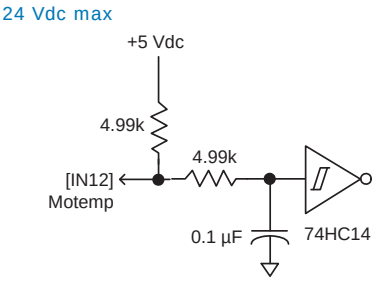


SINGLE-ENDED ENCODER



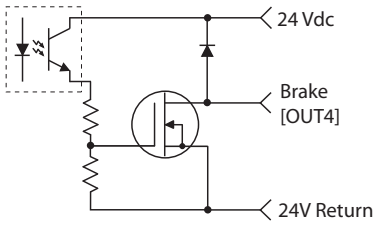
MOTOR OVERTEMP INPUT

This input connects to the feedback connector and is configured to work with motor overtemp switches or PTC (Positive Temperature Coefficient) resistors. It is programmable and can be used as a general purpose input. The active level is programmable HI or LO to interface with normally-open (NO) or normally-closed (NC) switches.
If not used for the motor temp function, the input may be programmed for other functions as a general-purpose digital input.

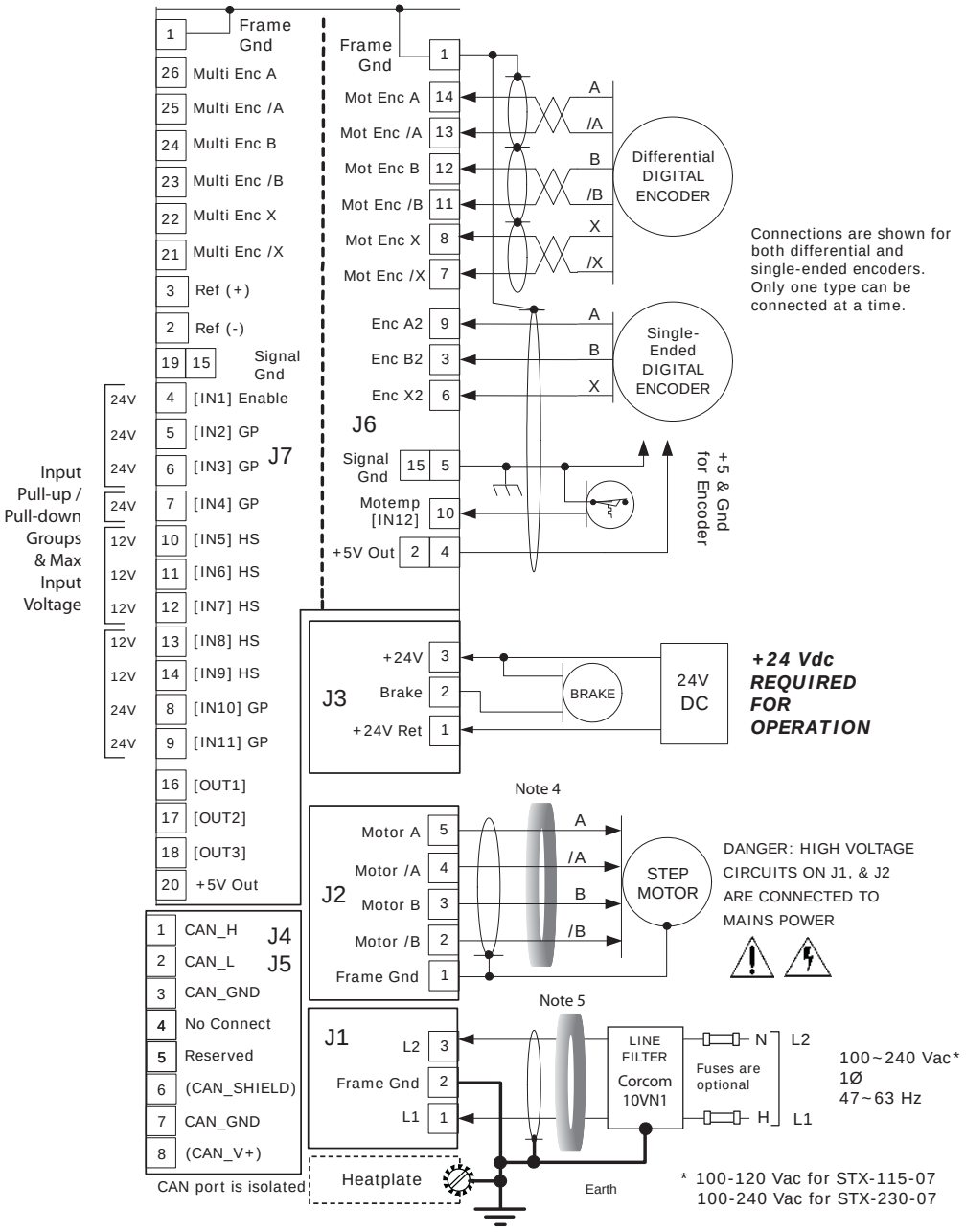


MOTOR BRAKE OUTPUT

This is an optically isolated output with a higher current rating for driving motor brakes which are inductive loads. It can sink 1 Adc and has a flyback diode that is connected to the AuxHV input (+24 Vdc). Brake timing and function is programmable.



DRIVE CONNECTIONS



NOTES

1. The functions of input signals on J7-5,6,7,8,9,10,11,12,13,14, and J6-10 are programmable.
2. The function of [IN1] on J5-4 is always Drive Enable and is not programmable.
   The active level of [IN1] is programmable, and resetting the drive or clearing faults with changes on the enable input is programmable.
3. Pins J7-20, J6-2, and J6-4 connect to the same +5 Vdc @ 250 mAdc power source.
   Total current drawn from all pins cannot exceed 250 mAdc.
4. A clamp-on ferrite (Fair-Rite PN 0431164281) was used on the motor cable (single turn) to meet EMC requirements during qualification testing.
5. A clamp-on ferrite (Fair-Rite PN 0431164951) was used on the AC input cable between the filter and drive (single turn) to meet EMC requirements during qualification testing.

CONNECTORS & SIGNALS

J1 AC POWER

J1 Power	
Signal	Pin
L2	3
Frame Ground	2
L1	1

J1 CABLE CONNECTOR:
Wago: 721-203/026-045/RN01-0000
Insert/extract lever: Wago: 231-131

J2 MOTOR

J2 Motor	
Signal	Pin
Motor A	5
Motor /A	4
Motor B	3
Motor /B	2
Frame Ground	1

J2 MOTOR CABLE CONNECTOR:
Wago: 721-605/000-043/RN01-0000
Insert/extract lever: Wago: 231-131

J3 24VDC & BRAKE

J2 24Vdc & Brake	
Signal	Pin
+24 Vdc	3
Brake Output	2
0V (24V Ret)	1

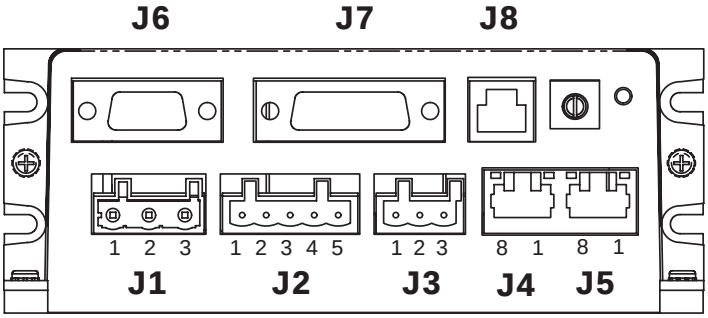
J3 24VDC & BRAKE CONNECTOR:
Wago: 721-103/026-047/RN01-0000
Insert/extract lever: Wago: 231-131

J4-J5 CAN BUS

PIN	SIGNAL
1	CAN_H
2	CAN_L
3	CAN_GND
4	No Connection
5	Reserved
6	(CAN_SHLD) [1]
7	CAN_GND
8	(CAN_V+) [1]

CAN circuits are optically-isolated from drive circuits

J4, J5 CABLE CONNECTOR:
RJ-45 style, male, 8 position
Cable: 8-conductor, modular type



J6 FEEDBACK

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	Frame Gnd	6	Encoder X2	11	Encoder /B
2*	+5 Vdc (Note 1)	7	Encoder /X	12	Encoder B
3	Encoder B2	8	Encoder X	13	Encoder /A
4*	+5 Vdc (Note 1)	9	Encoder A2	14	Encoder A
5	Signal Gnd	10	[IN12] Motemp	15	Signal Gnd

J6 CABLE CONNECTOR:
Norcomp: 180-015-103L001 connector
Norcomp: 979-009-020R121 backshell

J7 CONTROL SIGNALS

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	Frame Gnd	10	[IN5] HS	19	Signal Gnd
2	Ref(-)	11	[IN6] HS	20*	+5 Vdc (Note 1)
3	Ref(+)	12	[IN7] HS	21	Multi Encoder /X
4	[IN1] Enable	13	[IN8] HS	22	Multi Encoder X
5	[IN2] GP	14	[IN9] HS	23	Multi Encoder /B
6	[IN3] GP	15	Signal Gnd	24	Multi Encoder B
7	[IN4] GP	16	[OUT1]	25	Multi Encoder /A
8	[IN10] GP	17	[OUT2]	26	Multi Encoder A
9	[IN11] GP	18	[OUT3]		

J7 CABLE CONNECTOR:
Norcomp: 180-026-103L001 connector
Norcomp: 979-015-020R121 backshell

J8 RS-232

J8 RS-232	
Pin	Signal
6	No Connect
5	TxD Output
4	Signal Ground
3	Signal Ground
2	RxD Input
1	No Connect

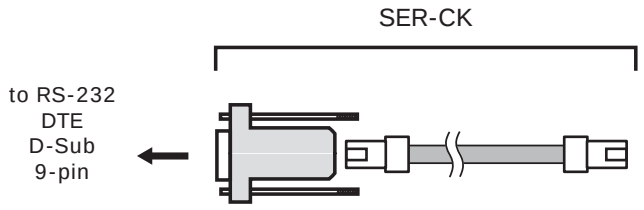
* Pins J7-20, J6-2, and J6-4 connect to the same +5 Vdc @ 250 mAdc power source. Total current drawn from all pins cannot exceed 250 mAdc.

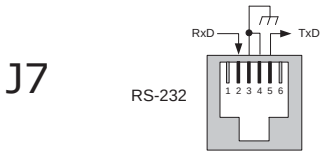
J8 CABLE CONNECTOR:
RJ-11 Modular type, 6-position, 4 used

CABLING FOR COMMUNICATIONS

RS-232

The Serial Cable Kit (SER-CK) is a complete cable assembly that connects a computer serial port (COM1, COM2) to the drive. The adapter plugs into a PC's COMM port that supports RS-232 and accepts a modular cable that connects the adapter to the drive's J7.

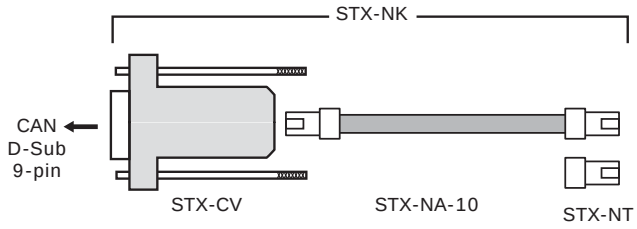




Note: Computers & drives are both DTE devices.
RxD (Received Data) signals are inputs.
TxD (Transmitted Data) signals are outputs.

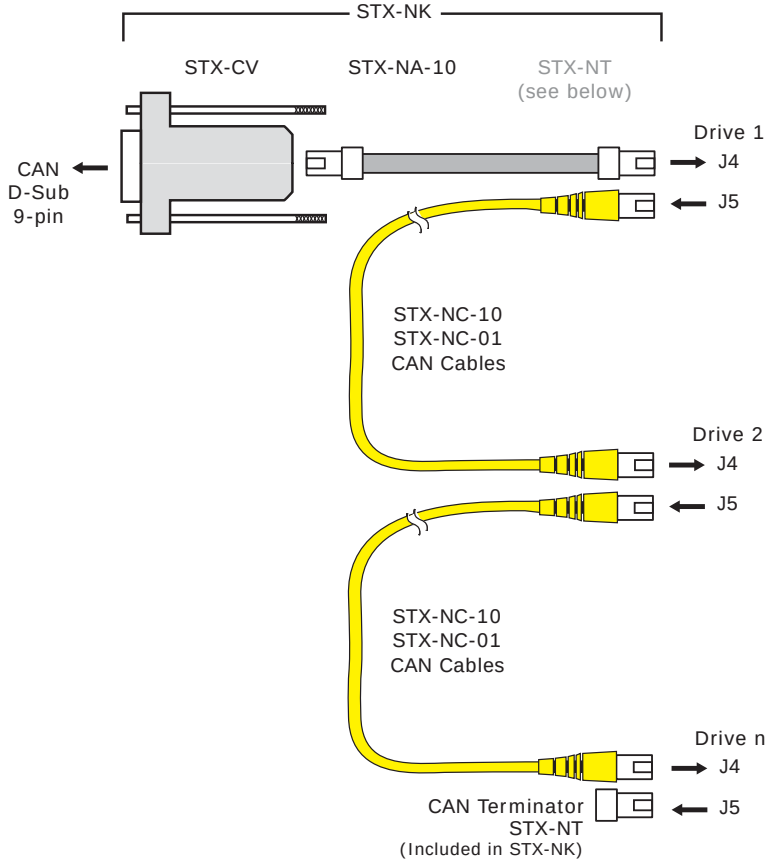
CANOPEN

SINGLE NODE



The connector kit for CAN networking (STX-NK) provides the parts to connect to a single drive. These comprise the adapter that converts the CAN D-Sub 9 connection to an RJ-45 type, a 10 ft (3m) modular cable, and a termimator that plug into an RJ-45 socket. The CAN address of the drive must between 1 and 127.

MULTI-NODE



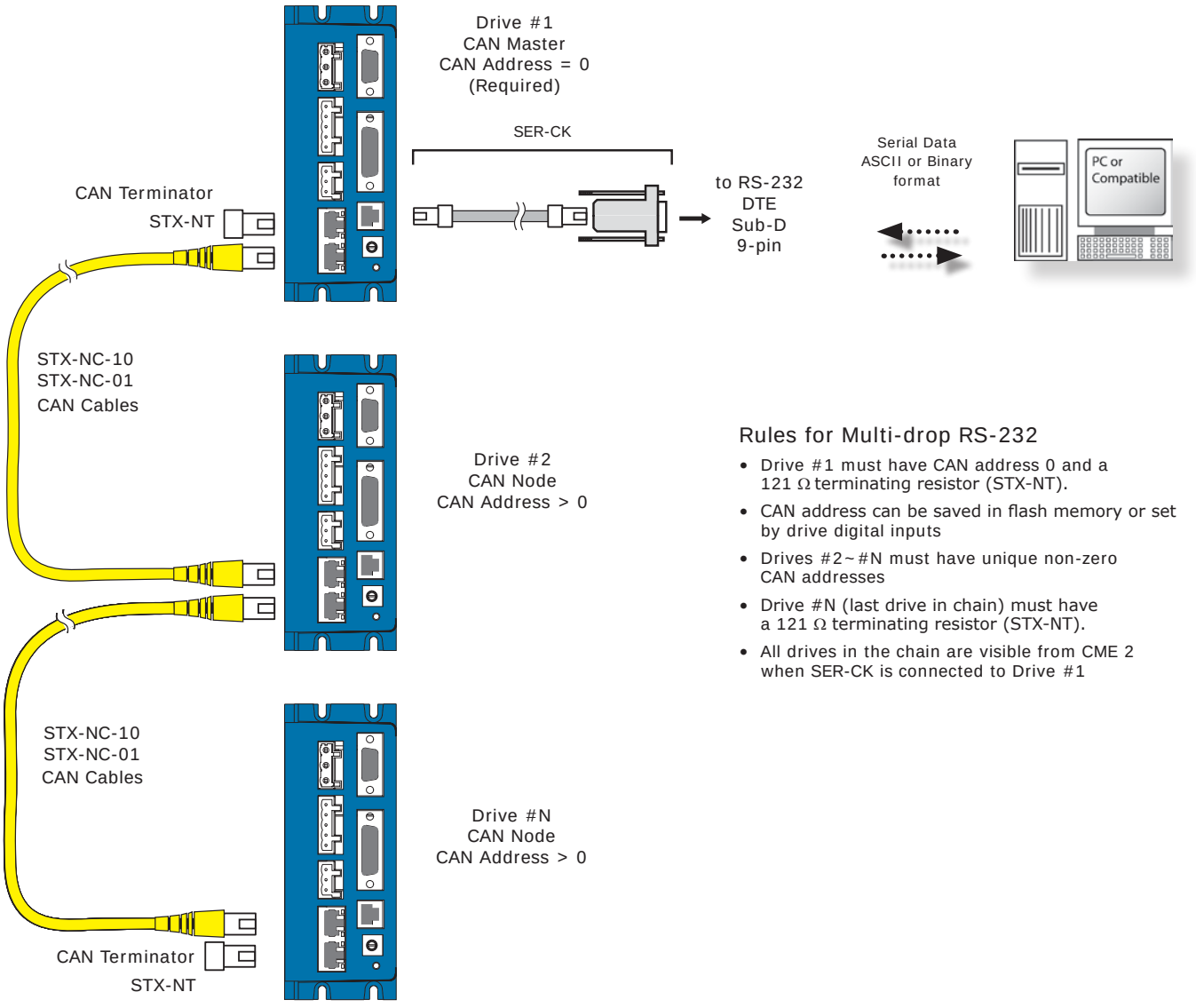
For multi-drive configurations over the CAN bus, the STX-NK is used in combination with CAN cables of the desired length. The network terminator is moved to the last drive in the chain and CAN cables daisy-chain from drive to drive to complete the signal path. Each drive must have a unique CAN node address between 1 and 127. CAN node address 0 is reserved for the CAN controller.

CABLING FOR COMMUNICATIONS

MULTI-DROP RS-232

The RS-232 specification does not support multi-drop (multiple device) connections as does RS-485 or CAN. However, it is possible to address multiple CAN-enabled Copley drives (*Accelnet, Stepnet, Xenus*) from a single RS-232 port. First, an RS-232 connection is made between the computer and drive #1 which must be given a CAN address of 0. Under normal CAN operation, this address is not allowed for CAN nodes. But, in this case, drive #1 will act as a CAN master and so address 0 is allowed. Next, CAN connections are made between drive #1, drive #2, and so on in daisy-chain fashion to the last drive. The first and last drives in the chain must have the CAN terminator (121 Ω resistor) between the CAN_H and CAN_L signals to act as a line-terminator. Finally, the CAN addresses of the drives downstream from drive #1 are set to unique numbers between 1 and 127.

When ASCII data is exchanged over the serial port, the commands are now preceded with the node address of the drive. Drive #1 converts the data into CAN data which is then sent to all of the drives in the chain. It now appears as though all drives in the chain are connected to the single RS-232 port in the computer and for that reason we refer it as *multi-drop* RS-232.

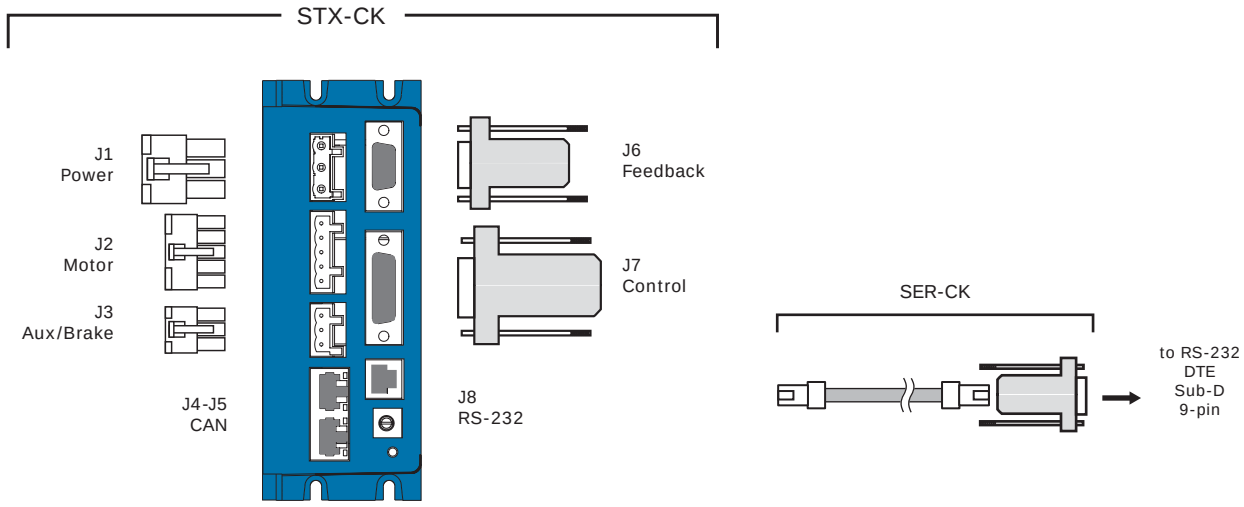


Rules for Multi-drop RS-232

- Drive #1 must have CAN address 0 and a 121 Ω terminating resistor (STX-NT).
- CAN address can be saved in flash memory or set by drive digital inputs
- Drives #2~#N must have unique non-zero CAN addresses
- Drive #N (last drive in chain) must have a 121 Ω terminating resistor (STX-NT).
- All drives in the chain are visible from CME 2 when SER-CK is connected to Drive #1

STAND-ALONE OPERATION

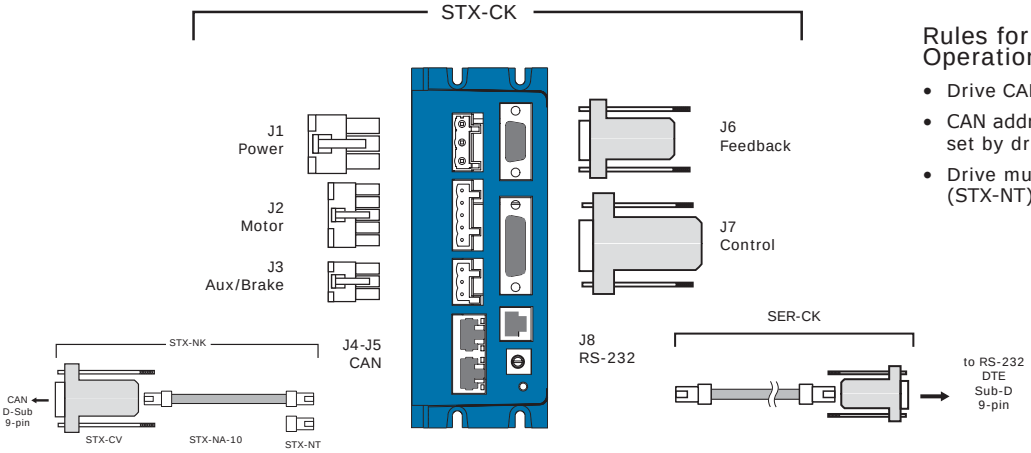
Drive takes digital position commands in Pulse/Direction, or CW/CCW format from an external controller or quadrature encoder signals from a master-encoder for electronic gearing. Velocity or torque control can be from ±10 Vdc or digital PWM signals. *CME 2* used for setup and configuration.



Notes:
1. The STX-CK kit contains connector shells and crimp-contacts for J3~J6.
2. Crimp-contacts are not shown
3. The SER-CK Serial Cable Kit is for connection to the RS-232 port, J8.
4. The STX-NK CAN Connector Kit is for connection to the CAN ports, J4~J5.

SINGLE-DRIVE SETUP FOR CANOPEN CONTROL

Drive operates as a CAN node. All commands are passed on the CAN bus. *CME 2* is used for setup and configuration before installation as CAN node.



Rules for Single-Drive CANopen Operation

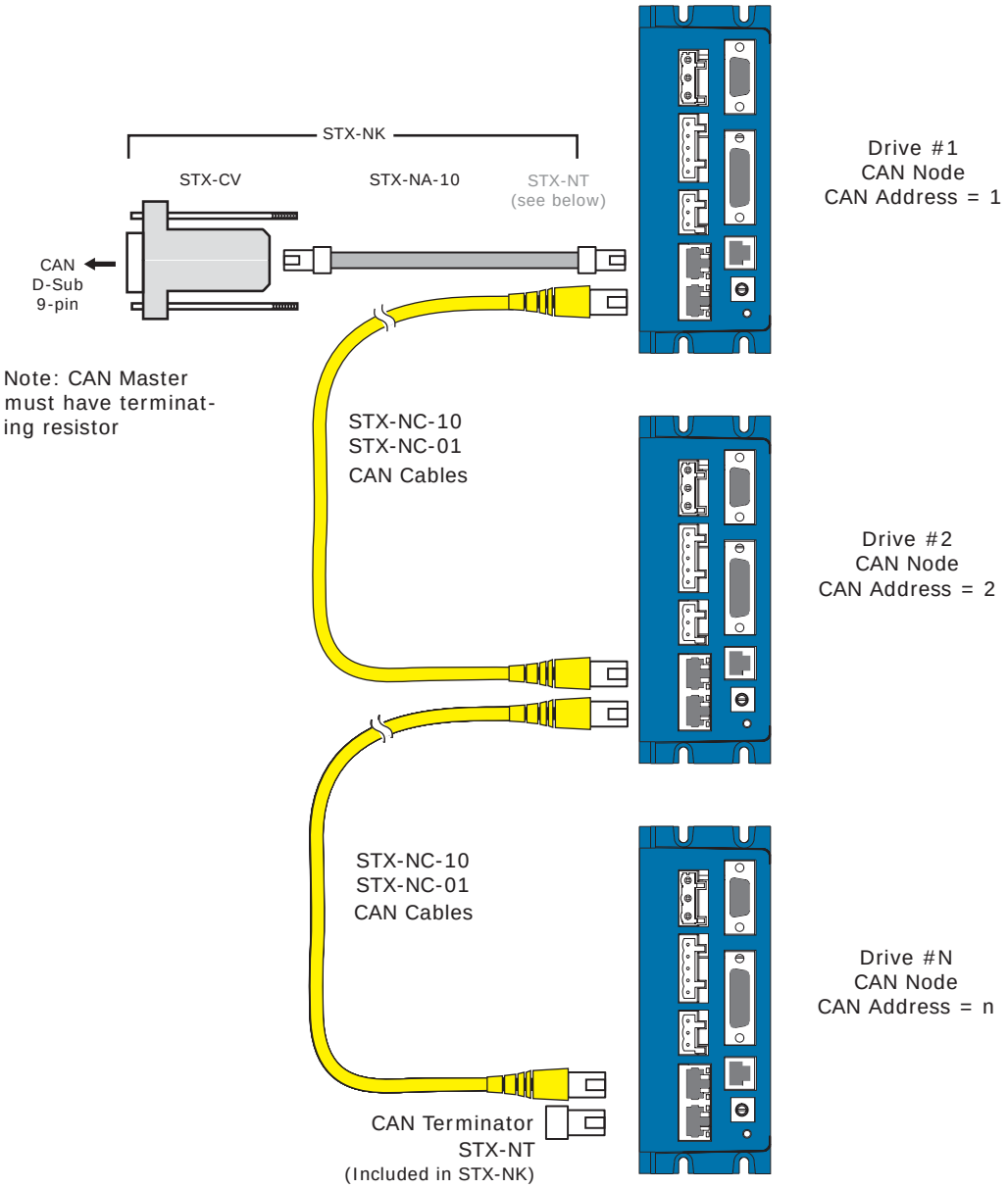
- Drive CAN address must be > 0
- CAN address can be saved in flash memory or set by drive digital inputs
- Drive must have a 121 Ω terminating resistor (STX-NT) if it is the last drive on the CAN bus.

Notes:
1. The STX-CK kit contains connector shells and crimp-contacts for J3~J6.
2. Crimp-contacts are not shown
3. The SER-CK Serial Cable Kit is for connection to the RS-232 port, J8.
4. The STX-NK CAN Connector Kit is for connection to the CAN ports, J4~J5.

MULTIPLE-DRIVE SETUP FOR CANOPEN CONTROL

Rules for Multiple-Drive CANopen Operation

- All drives must have CAN addresses > 0 and no drives can have the same CAN address
- CAN address can be saved in flash memory or set by drive digital inputs
- Drive #n (last drive in chain) must have a 121 Ω terminating resistor (STX-NT)
- The CAN Master must have a 121 Ω terminating resistor



MOUNTING AND COOLING

The ability of the drive to output current at a particular ambient temperature is greatly affected by the way it is mounted and the way that air circulates across the heatplate which is the primary path for heat flow between the internal transistors and the environment. Thermal resistance is a measure of the temperature difference between the transistors and the environment per Watt of power dissipation. The data on this page show the thermal resistance under different mounting and cooling configurations.

NO HEATSINK, CONVECTION COOLED

The drive is vertical with convection cooling. No force-air from a fan* or heat-sinking by mounting to a heat-dissipating surface.

Thermal Resistance
2.2 ºC/W

NO HEATSINK, FAN-COOLED

The drive is vertical with fan-cooling* with an air-flow of at least 200 LFM.

Thermal Resistance
1.1 ºC/W

WITH HEATSINK, CONVECTION COOLED

The drive is vertical with no fan-cooling and the heatsink is mounted.

Thermal Resistance
1.2 ºC/W

WITH HEATSINK, FAN-COOLED

The drive is vertical with fan-cooling* with an air-flow of at least 200 LFM and the heatsink is mounted.

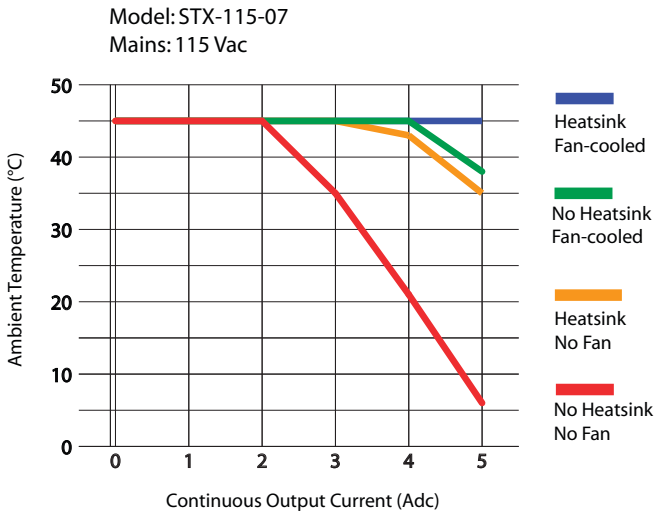
Thermal Resistance
0.6 ºC/W

* Fans are user-supplied.

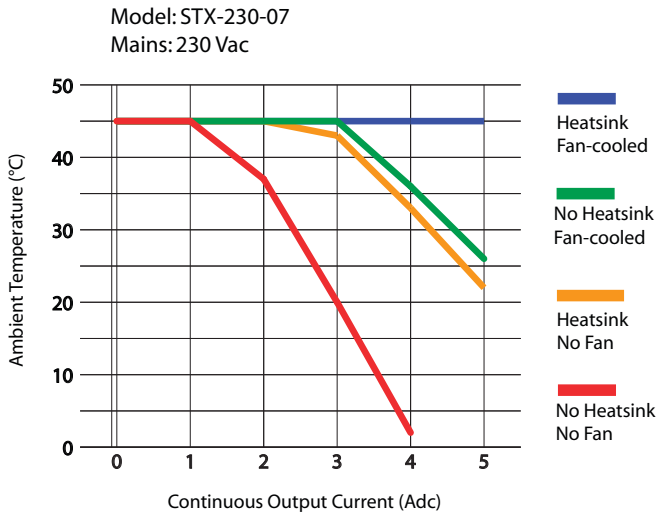
MAXIMUM AMBIENT TEMPERATURE VS. OUTPUT CURRENT, MOUNTING, AND COOLING

The graphs below show the maximum ambient operating temperature for the drive vs. output current for the *Stepnet AC* models at 115 and 230 Vac mains voltages and under different mounting and cooling conditions shown on the previous page.

STX-115-07



STX-230-07

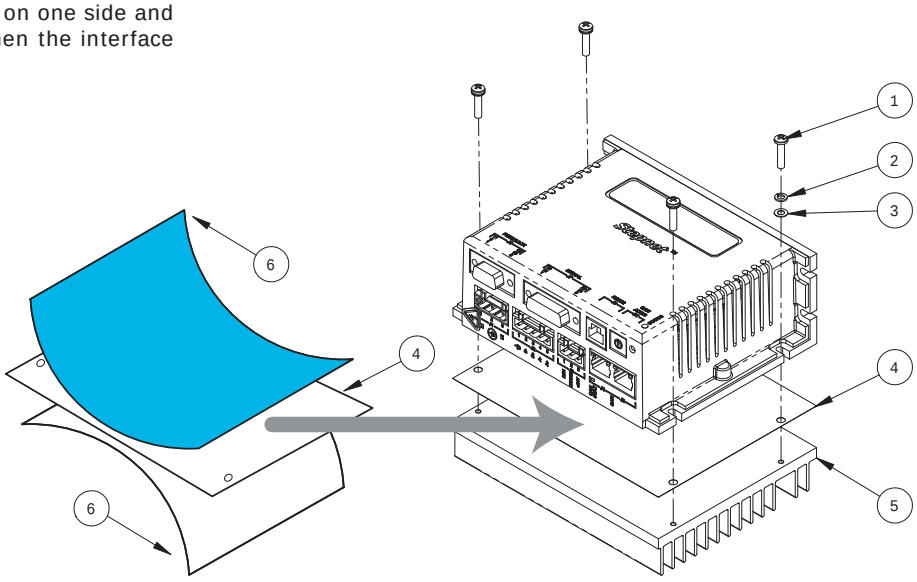


HEATSINK MOUNTING

A dry-film interface pad is used in place of thermal grease. The pad is die-cut to shape and has holes for the heat sink mounting screws. There are two protective sheets, blue on one side and clear on the other. Both must be removed when the interface pad is installed.

STEPS TO INSTALL

1. Remove the blue protective sheet from one side of the pad and place the pad on the drive. Make sure that the holes in the pad align with the holes on the drive.
2. Remove the clear protective sheet from the pad.
3. Mount the heatsink onto the drive taking care to see that the holes in the heatsink, pad, and drive all line up.
4. Torque the #6-32 mounting screws to 8~10 lb-in (0.9~1.13 N·m).



Parts shown:
1) #6-32 mounting screw (4)
2) #6 split lockwasher (4)
3) #6 flat washer (4)
4) Thermal interface material
5) Heatsink
6) Protective sheets (2)

MASTER ORDERING GUIDE

STX-115-07	*Stepnet AC* Stepper drive 5/7 Adc @ 100~120 Vac
STX-230-07	*Stepnet AC* Stepper drive 5/7 Adc @ 200~240 Vac

Add "-H" to part number for factory-installed heatsink

ACCESSORIES

	QTY	REF	DESCRIPTION	MANUFACTURER PART NO.
Drive Connector Kit STX-CK	1	J1	Plug, 3 position, 7.5 mm, female	Wago: 721-203/026-045/RN01-0000
	1	J2	Plug, 5 position, 5.0 mm, female	Wago: 721-605/000-043/RN01-0000
	1	J3	Plug, 3 position, 5.0 mm, female	Wago: 721-103/026-047/RN01-0000
	1	J6	High density D-Sub, male, 15 position, solder-cup	Norcomp: 180-015-103L001
	1	J6	Backshell for J6 plug	Norcomp: 979-009-020R121
	1	J7	High density D-Sub, male, 26 position, solder-cup	Norcomp: 180-026-103L001
	1	J7	Backshell for J7 plug	Norcomp: 979-015-020R121
	2	J1,J2,J3	Wire insertion/extraction tool	Wago: 231-131
CANopen Connector Kit STX-NK	1	J4,J5	STX-CV Cable adapter: D-Sub 9F to RJ-45 receptacle, for CAN cables	
	1		STX-NC-10 CANopen cable assembly, 10 ft (3 m)	
	1		STX-NT CANopen network teminator (J4 plug with 121Ω resistor)	
STX-CV		J4,J5	Cable adapter: D-Sub 9F to RJ-45 receptacle, for CAN cables	
STX-NC-10		J4,J5	CANopen cable assembly, 10 ft (3 m)	
STX-NC-01		J4,J5	CANopen cable assembly, 1 ft (0.3 m)	
STX-NT		J4,J5	CANopen network teminator (J4 plug with 121Ω resistor)	
SER-CK		J8	Serial Cable Kit: D-Sub 9F to RJ-11 adapter + 6 ft (1.8 m) modular cable for drive J7	
CME 2			CME 2™ CD (CME 2)	
Heatsink Kit STX-HK		1	STX Heatsink	
		1	STX Heatsink thermal material	
		AR	STX Heatsink hardware	

ORDERING EXAMPLE

Example: Order 1 STX-115-07 drive with heatsink and associated components:

Qty	Item	Remarks
1	STX-115-07-H	*Stepnet AC* stepper drive
1	STX-CK	Connector Kit
1	SER-CK	Serial Cable Kit
1	CME2	CME 2™ CD

ADD A CAN BUS INTERFACE TO YOUR COMPUTER:

Copley's CAN-PCI-02 provides two fully isolated CAN channels in a PCI-card form-factor and works with the STX-NK connector kit.