TRANS-4, MICRO-STEPPING TRANSLATORS

42 Volt, 4 Ampere per Phase

Contents

TRANS-4, MICRO-STEPPING TRANSLATOR

TRANS-4 is a low cost micro-stepping power stage intended to drive small to medium sized two-phase step motors. The micro-stepping logic divides the full step in 8 partial steps. With an industry standard motor (1.8 degree/step), the resulting resolution is 1600 micro-steps per revolution. Half-step and quarter-step logic are available on special order.

The two MOSFET full bridges use a current control scheme combining "fast and slow decay" modes in order to achieve low current ripple and best high speed performance.

Automatic current reduction at rest is jumper selectable (60 % of set value).

Two versions of pulse input are available:

Version A: Pulse and Direction,
Version B: Forward Pulse and Backward Pulse.

Stepping on the leading or the trailing edge of the pulse is selected by a jumper. This is of importance to avoid false counting when the direction changes. The command inputs are isolated by uncommitted opto-isolators.

Extensive protection circuitry have been designed into the translator:

- Over- and Under-Voltage,

- Over Current or Short Circuits,

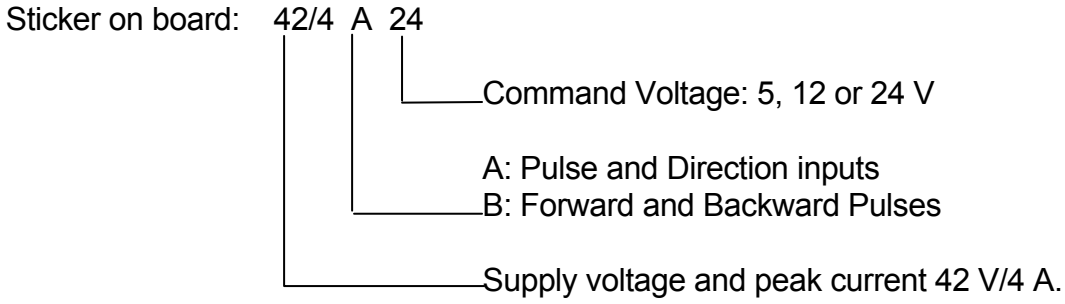
- Over-Temperature

- Limit Switch Inputs for both travel directions.

Tripping of a protective circuit lights the FAULT LED and sets the FAULT output.

Thermal Design: TRANS-4 has its own heat dissipator. If necessary, additional heat dissipation capability is obtained by monting the translator on an available heat sink, such as the machine structure.

1. AVAILABLE MODELS



TRANS4 A: wire connection for command signals
TRANS4 D: 10p Header connection for command signals (direct to EIP controller)

2. TERMINAL DESCRIPTION

2.1. J1 Connector, Power and Motor

TERMINAL	SIGNAL	FUNCTION
J1-1 **J1-2**	PHASE B2 PHASE B1	Motor Winding
J1-3	+UM	Positive supply voltage to the motor H-bridge, see sect. 3
J1-4	+UL	Positive supply voltage to the logic, may be tied to J1-3
J1-5,6	0 V	Supply voltage return, 2 pins parallel connected
J1-7 **J1-8**	PHASE A2 PHASE A1	Motor Winding

2.2. J2 Connector, Control signals (TRANS4-A, wire connection type)

TERMINAL	SIGNAL	FUNCTION
J2-1 **J2-2**	--Pulse or -FWD Pulse +Pulse or + FWD Pulse	Opto-isolated pulse input, Forward pulse input for B-version. + is the anode terminal, - is the cathode terminal of the opto-isolator.
J2-3 **J2-4**	--DIR or -BKW Pulse +DIR or + BKW Pulse	Opto-isolated direction input, Backward pulse for B-version. + is the anode terminal, - is the cathode terminal of the opto-isolator.
J2-5 **J2-6**	--FAULT, emitter +FAULT, collector	Fault output, uncomitted Darlington opto-isolator. A fault condition or an active limit switch at the proper direction activates the FAULT output.
J2-7	+ 15 V out	Supply to the limit-switches, current is limited by 330 ohm
J2-8	0 V, tied to J1-5,6	Common to the limit-switches
J2-9 **J2-10**	/FWD LSW /BWD LSW	The limit switch input inhibits a motion in the designated direction; motion in the opposite direction is still possible. FAULT is active when the motion is inhibited. If not used, must be tied to J2-7, needs a N.C contact.

3. SUPPLY

The translator module TRANS-4 must be powered by a rectified ans smoothed voltage. The voltage range is 24 to 55 V. See also the absolute maximal values. The current drawn from the supply depends upon the current setting, the motor size and winding, the operating speed and torque. As a rule of thumb, on can admitt that the current will never exceed **2** Amp at 42 V.

A electrolytic capacitor of at least 1000 μF is required, not only to filter out the ripple but also to store the braking energy with a reasonable voltage rise. Twisted wire pair is recommended for the supply wiring. Several translators can be powered from a single supply by daisy chaining the supply connections.

If required by machine safety regulations, the supply of the motor bridge can be switched off while maintening the translator logic powered i.e. while preserving the motor field position. A normally open contact of a forced operation relay will be inserted into the wire to pin 3 of J1. This contact is opened by the machine safety logic whenever the operator has access to the moving parts. It will be good practice to insert an inrush current limiter in this power lead in order to limit the charging current of the on board capacitor. A resistor with a delayed shorting contact or an NTC resistor are suitable solutions, ask E.I.P. SA for more information.

If the safety feature is not needed, symply connect the positive terminal of the supply to pins 3 and 4 of J1.

4. MOTOR CONNECTION

Suitable 2-phase motors are 4-wire or 8-wire types. With 8-wire motors it is generally preferable to parallel connect the two windings of the same phase. Refer to the motor notice to establish the proper connections. (The motors with a tight terminal box sold by E.I.P. SA are already parallel connected.) Remember that an 8-wire motor specified for a phase current I can be operated at I√2 when parallel connected.

Center tapped 6-wire motors can be used by letting the center tap unconnected. However, the large back emf and inductance of the serie connected windings will provide poor high speed performence.

The motor cable must be shielded to comply with EMC regulations. The shield has to be connected to the earthed cabinet and to the earthed motor. If shielding is not possible, keep the motor cable in a separate duct, at least 15 cm from other sensitive wiring.

5. INPUT CONNECTIONS

The 2 inputs: PULSE, DIR.(resp FWD and BWD Pulses) use the input circuit of Figure 1. The diode D protects the opto-isolator from wrong polarity and sets a low threshold to the command current. The value of resistor R depends upon the particular input and the nominal command voltage, see table.

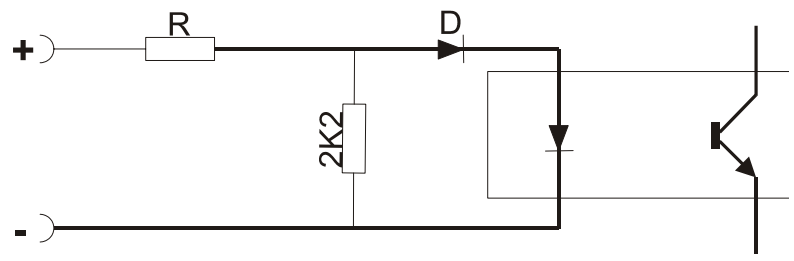


Figure 1 : **Input Circuit**

Resistor Value :

COMMAND VOLTAGE	**FD** and **DIR**
5 V	180 Ω [2)]
12 V	560 Ω [1)]
24 V	1.2 kΩ [1)]

[1)] Figure 1 [2)] Figure 2

If the signal source is an open collector n-p-n transistor (sink driver), connect the collector to the - terminal and the proper voltage to the + terminal. With a source driver, connect the - terminal to the ground.

With an RS 422/485 line driver as a signal source, use the 5 V command voltage and the circuit of Figure 2. The resistor across the terminals may be required to suppress the reflections in long transmission lines. Its value must be found be trials. The line driver should deliver a differential voltage of 3 V for best results.

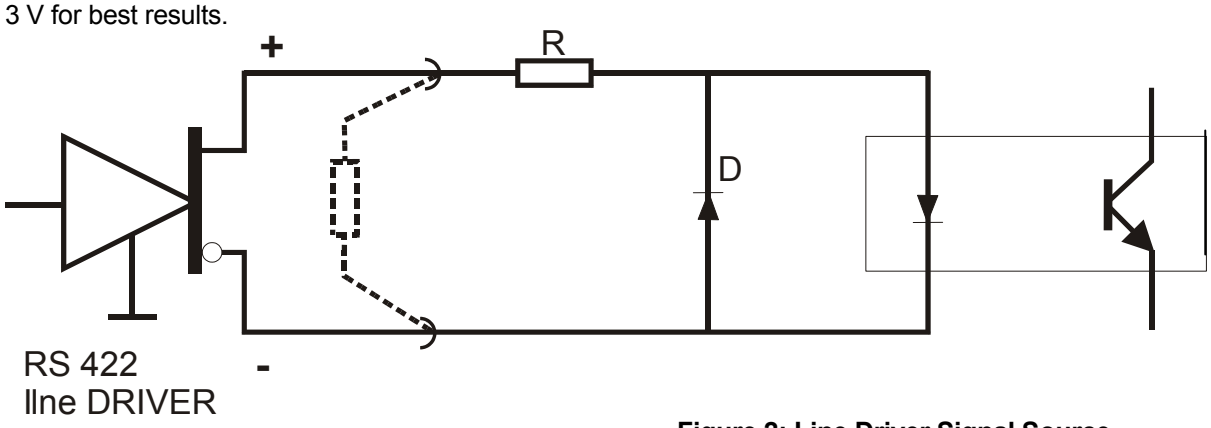


Figure 2: Line Driver Signal Source

6. COMMAND PULSE POLARITY

The jumper "MODE" selects the active edge of the command pulse. This selection is of importance with the Pulse/Direction command mode (A-model) in order to avoid false stepping when the direction changes. With the jumper on, the motor steps on the leading edge of the current pulse into the opto-isolator.

7. CURRENT SETTING

The peak value of the sinusoidal winding current is set via the multi-turn potentiometer. Turning the pot CW increases the current. The current can be set from almost 0 to 4 A. With the jumper "ECONOMY" on, the current is automatically reduced to abaout 60 % of the set value for a step frequency below a few Hertz. Remove the jumper when full current is desirable at rest.

8. PROTECTIVE CIRCUITS and LED INDICATORS

The under-voltage and over-voltage conditions are detected and signalled as fault condition. An over-volt may happen during regenerative braking if the capacitor across the supply is too small. See the electrical characteristics for the trip voltages. A temperature of the transistor mounting plate of about 75 °C is a further fault condition.

The over-current detector is tripped by any short circuit condition in the motor leads or by a defective current control inside the module. This fault is latched and the over-current latch can only be resetted by switching the supply voltage UL off.

The fault conditions above shut the current down and turn the FAULT output and the LED "FAULT" on. The FAULT output is a Darlington opto-isolator; it can directly drive a small relay or, whith a suitable load

resistor, it can be configured to drive the input of a controller either as a source or as a sink driver.

9. THE LIMIT SWITCHES

/FWD LSW and /BKW LSW are direction dependant travel limit inputs. When a limit switch input is active (low), a step pulse in the designated direction shuts the current down, activates the FAULT output and lights the "LIMIT SWITCH" LED. Motion in the opposite direction is still possible and FAULT goes to zero when the slide is within the travel limits again.

The limit switch pins are active-low inputs. Normally closed switches -or functionally equivalent proximity detectors- must be used as limit switches. When not used, these inputs must be tied to terminal J2-7. These inputs have an internal 10 kΩ pull-down resistors and they are not isolated from the supply 0 V.

10. MOUNTING and COOLING

The TRANS-4 driver must be mounted vertically. A least 30 mm of free space must be allocated over and under the module to allow air circulation. The mounting requires two M5 screws 105 mm apart, see the dimensional sketch.

The cooling requirements strongly depend upon the current and the duty cycle. In almost all practical situations, the integral heat dissipating plate is sufficient. With an ambiant temperature over 35 °C and high working rates, additionnal heat sinking through the mounting base may be necessary. Always check the temperature in order to test the margin (trip point at 75 °C).

11. ABSOLUTE MAXIMUM RATINGS

PARAMETER	TERMINALS	VALUE
UM, UL, Supply Voltage	J1-3,4 to J1-5,6	max. 60 V DC
Input Command Voltage, PULSE, DIR	J2-2 to J2-1, J2-4 to J2-3	5 V Command Voltage: 6.2 V 12 V Command Voltage: 16 V 24 V Command Voltage: 27 V
Collector Voltage, FAULT Out	J2-6 to J2-5	35 V DC
Collector Current, FAULT Out	Current into J2-6	80 mA
Ambient Temperature		45 °C, Heat Sink Temperature internally limited

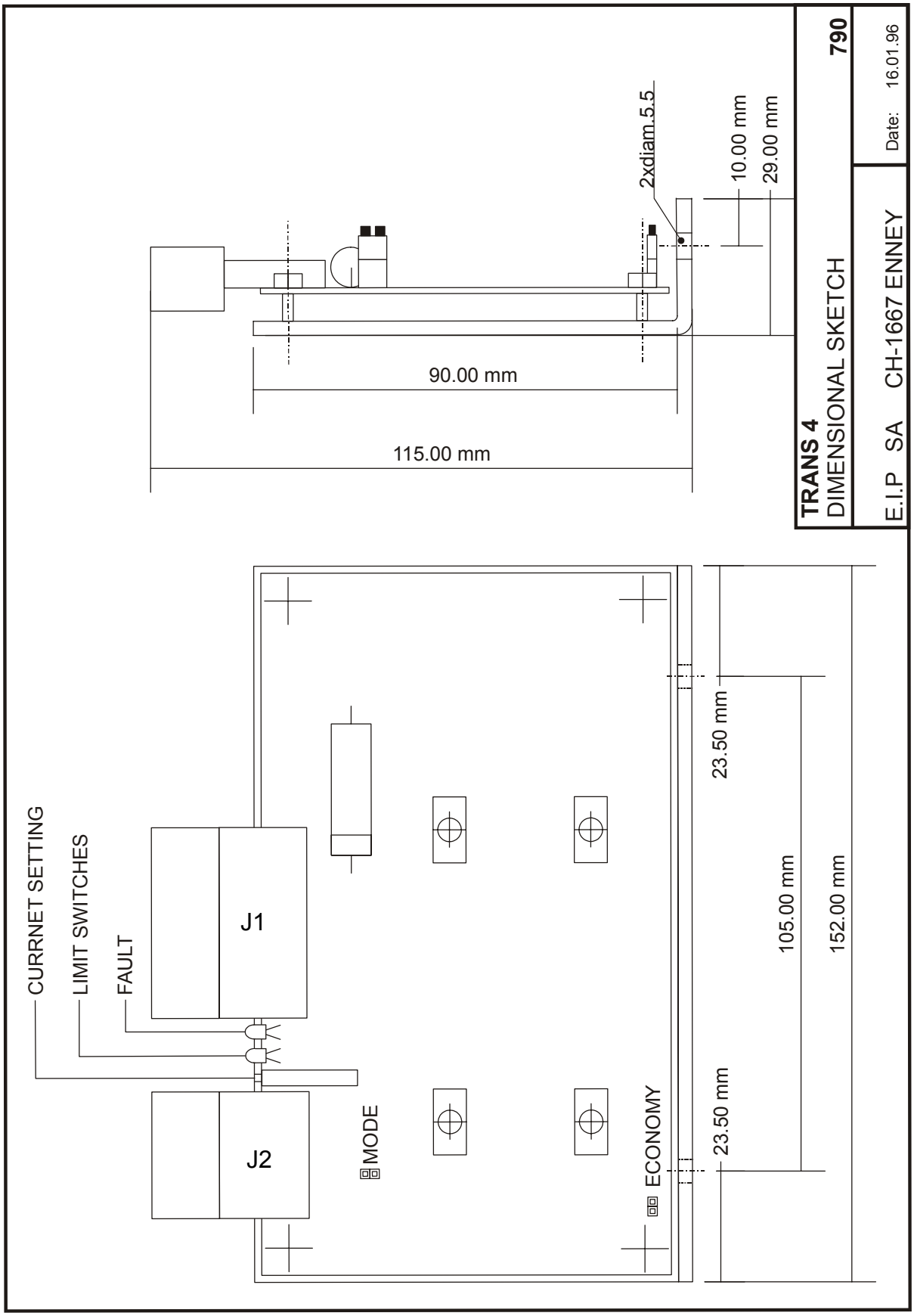
12. ELECTRICAL CHARACTERISTICS AND OPERATING CONDITIONS

PARAMETER	TERMINALS	MIN.	TYP.	MAX.
Command Voltage, PULSE and DIR	J2-2 to J2-1 and J2-4 to J2-3	2.5 V [1)] 6 V 12V	4 V [1)] 12 V 24 V	6.2V [1)] 16 V 27 V
Input Current @ typical Input Voltage, PULSE and DIR	into J2-2 or J2-4		13 mA [1)] 17 mA 18 mA	
PULSE and DIR, inactive	J2-2 to J2-1 And J2-4 to J2-3			1.6 V[1)] 2.8 V 3.6 V
Under-Volt Lockout	J1-3,4 to 0 V		25 V	
Over-Volt Lockout	J1-3,4 to 0 V		62 V	
Pulse and Pause Duration, PULSE and BKW PULSE	J2-2 - J2-1 or J2-4 - J2-3	8 μs		
Set-Up Time, DIR to PULSE		8 μs		
FAULT Saturation Volt @ 30 mA	J2-6 to J2-5			1.2 V
Limit Switch Voltage (inactive)	J2-9 or J2-10 to 0 V	6 V	12 V	30 V
Limit Switch Input Current @ typical Input Voltage	into J2-9 or J2-10		1.5 mA	
Limit Switch Input Volt. (active)	J2-9 or J2-10 to 0 V			3 V
Heat Sink Temperature Trip Point			75 °C	

[1)] According to the Nominal Command Voltage

The electrical parameters given in this data sheet are tentative. They can be changed after full characterization without notice.

E.I.P. SA January 2006


TRANS 4
DIMENSIONAL SKETCH
790
E.I.P SA CH-1667 ENNEY
Date: 16.01.96
2xdiam.5.5
10.00 mm
29.00 mm
90.00 mm
115.00 mm
CURRNET SETTING
LIMIT SWITCHES
FAULT
J1
J2
MODE
ECONOMY
23.50 mm
105.00 mm
152.00 mm
23.50 mm