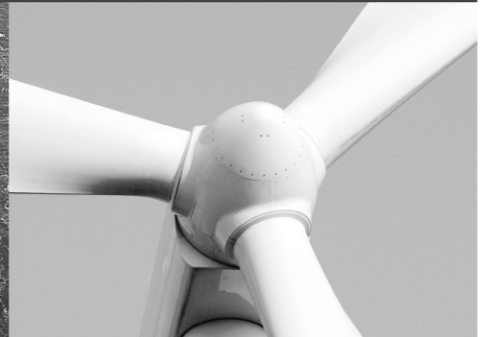




-power in control



Thyristor Control Module, TCM-2 DATA SHEET



Typical applications

- Heavy duty cut-in controller for asynchronous wind turbine generators
- Advanced cut-in by acceleration-depending double cut-in ramp
- Strongly reduced grid impact under cut-in
- Stand-alone unit with external rpm pulse sensor on generator shaft
- Applicable for 1- and 2-speed asynchronous generators
- -25 - +70°C



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Application

The TCM-2 is a microprocessor-based controller designed to minimise the grid impact at cut in and out. It works by interfacing directly to the 6-pulse thyristor bridge. The interface is designed as 6 highly insulated ignition pulse stages for generation of a 100kHz/500mA firing current for a broad range of thyristors with a gate voltage between 0 and 5V.

The device is designed to provide 6 digital inputs, 6 digital outputs and an analogue input (0-10V) line, and can therefore be used as a stand-alone controller. The IO lines are designed to withstand the environment.

The TCM-2 integrates directly into the power cabinet, thus functioning as a stand-alone thyristor controller for wind turbines with 1- or 2-speed asynchronous generators.

An input is dedicated to connecting a single-phased current measurement transformer (either 1Arms or 5Arms secondary mean current). This makes it possible to measure the actual thyristor current during operation.

The TCM-2 can be powered from either 18-36V DC or 19.2-30V AC. This flexibility makes it easy to integrate it into a power switchboard cabinet.

As a second mode of operation, the TCM-2 can be directly controlled via CAN bus. This makes it possible for other process control units to set the actual ignition angle for the thyristor bridge on a periodical base.

Thus, any control application based on a 6-pulse thyristor bridge can be implemented.

Stand alone mode rpm regulated wind turbine cut-in controller for asynchronous generators.

The ignition angle under cut-in is controlled in the following ways:

1. For low-, medium- and high-wind situations, the cut-in of both generator stages is implemented as an innovative strategy: Based on the measured generator shaft speed and actual grid frequency, a dynamical recalculation of an optimal 2-step ignition ramp is performed in real time. This calculated ramp allows a cut-in of an asynchronous generator, which in low-wind as well as in medium- and high-wind can provide minimum impact on the grid and drivetrain. This procedure is used for all cut-in procedures, both of the large and the small generator stage, except for the cut-down procedure (large to small generator), which is handled by a dedicated algorithm.

2. In the cut-down condition where the small generator stage is used as electrical brake, another regulation strategy for the ignition angle control is applied. This strategy is based upon minimising the mechanical loads by significantly reducing the voltage on the small generator when it crosses its maximum momentum at approximately +3% slip, i.e. shortly before reaching the normal operational speed.

Note: None of the regulation algorithms use the generator's phase angle between current and voltage of the generator as an input value for the algorithm. They are solely based on the rpm and the current amplitude measurement.

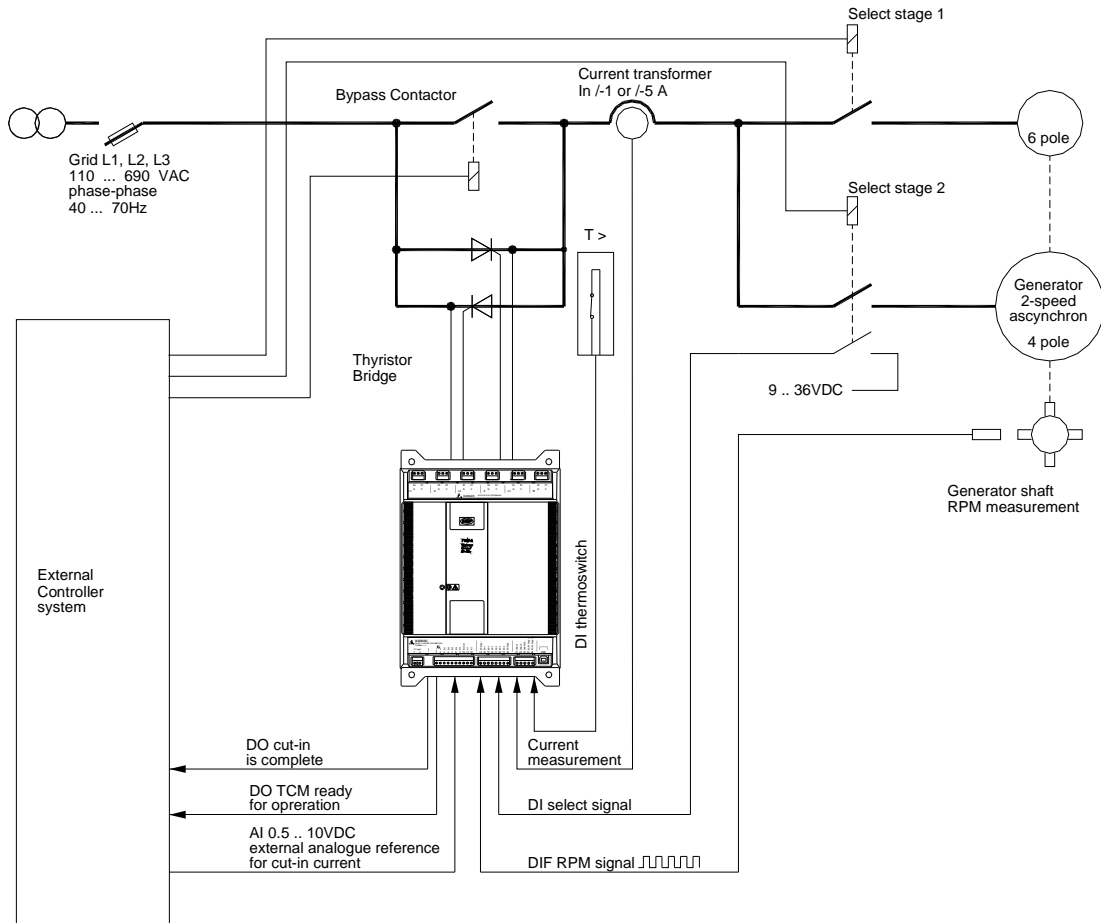
The ignition angle during motor start is controlled in the following way: The external analogue signal is interpreted as a set point for the desired generator current under motor start.

The thyristor bridge is regulated to obtain a generator current amplitude which produces an rms current of the size $(\text{Analogue Signal}/10\text{V}) * (1\text{A or }5\text{A})$ on the secondary side of the CT.

Options

The TCM-2 will be adapted and parameterised from DEIF to provide optimal performance for each type of application.

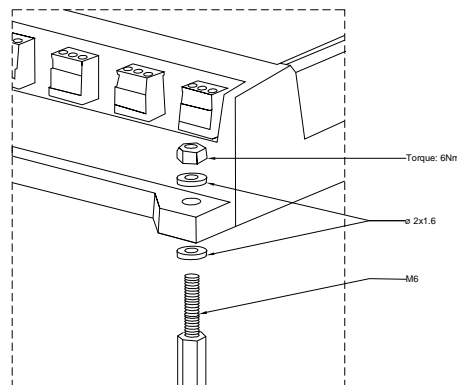
Operation mode diagram



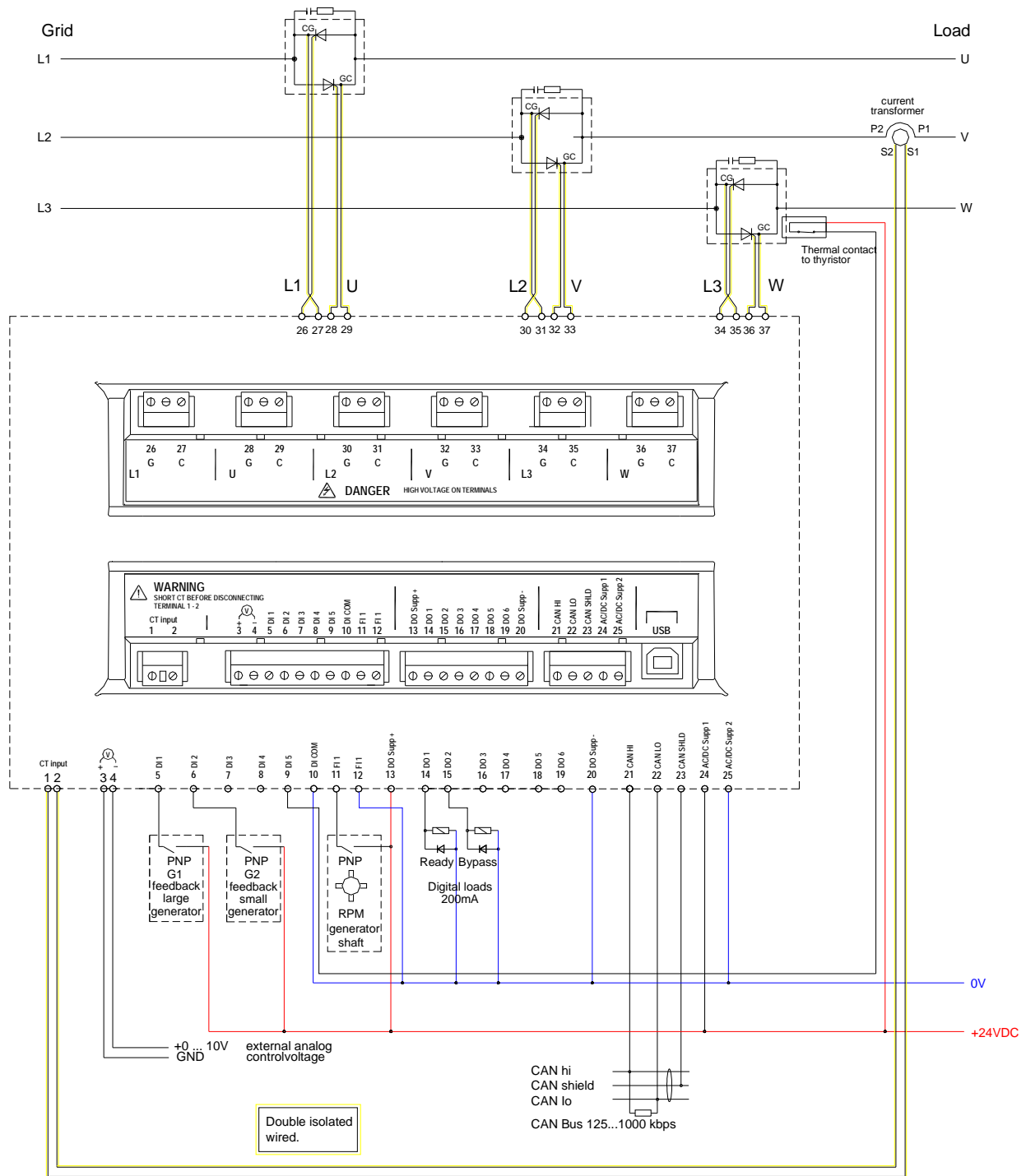
Mounting

The TCM-2 housing is designed to protect the electronics inside. It is easy to install the module using standard tools and parts. A description of torque and needed parts are provided.

Adapter plates for mounting the TCM-2 in existing switchboard cabinets are available on request.



Connection diagram

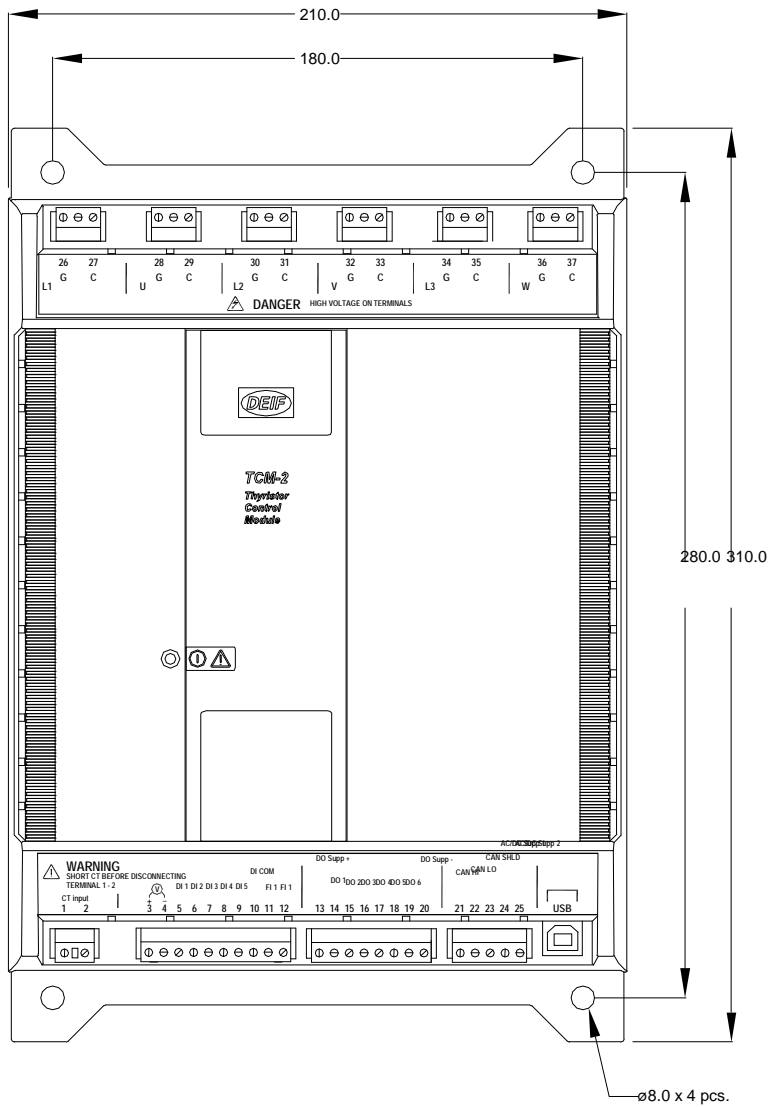


Technical specifications

Aux. supply:	18-36V DC or 19.2-30V AC Max. 2 A	Grid:	110V AC to 690V AC (phase-to-phase)
Operating temp.:	-25 – +70°C (-13 – +158° F)	UL/cUL R/C:	110...600V AC
Storage temp.:	-40...70°C (-40...158°F)	Frequency:	40-70 Hz
Climate:	97% RH to IEC 60068-2-30	Digital inputs:	9-36V DC, app. 2.4 kOhm, input optically insulated, PNP or NPN selectable as a group.
Operating altitude:	Max. 3,000 m	RPM input:	9-36V DC, app. 2.4 kOhm, optically insulated, PNP or NPN. 1 to 12 pulses per turn, duty cycle > 20%
Vibration:	3...13.2 Hz, 2 mm _{P-P} 13.2...100 Hz, 0.7 g To IEC 60068-2-6	Analogue input:	0-10 V, 10 kOhm, differential mode not gal- vanically insulated.
Shock:	50 g, 11 ms, half sine To IEC 60068-2-27	Current measurement input:	-/1 or -/5 Arms AC
Protection class:	IP20 to IEC/EN 60529	Accuracy:	Class 1.0 to IEC/EN 60688
Mounting:	Vertical or horisontal with thyristor terminals up or to the side for operation under full temp. range and protection class	Current overload:	4 * in continuously 20 * In for 10 s
UL/cUL R/C:	For use on a flat surface of a type 1 enclosure.	Digital outputs:	With external Supply 9-36V DC, max 1.5 V voltage drop, 200 mA source/sink continuously
Safety:	To EN 61010-1 overvoltage category III, 690V AC, pollu- tion degree 2	Wire size:	AWG 30-12
UL/cUL R/C:	To UL508C and CSA 22.2 No. 14-05 overvoltage category III 600 V, pollution degree 2.	Terminal tightening torque:	5-7 lb-in (0.5-0.7 Nm)
Material:	Plastic case, black, foil- covered. UL-94 V-0.	UL markings:	
Connectors:	PHÖNIX Screw terminals 20 Arms	Installation:	To be installed in accor- dance with the NEC (US) or the CEC (Canada).
Weight:	Approx. 1 kg	Approval:	CE & UL/cUL-recognised to UL508C and CSA 22.2 No. 14-10.
EMC/CE:	To EN 61000-6-2/4		
Thyristor ignition pulses:	500 mA current limited, 100 kHz, di/dt 1 A/us, Gate cathode voltage 0-5 V		

These controllers are in-
tended to be used in indus-
trial control panels where the
suitability of the combination
has been determined by Un-
derwriters Laboratories.

Unit dimensions in mm



Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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