## Terminal units (B50, B51, B52)

The drive control unit may be equipped with expansion I/O-units The customer connection terminals for these units are placed on terminal rail B50 at the bottom of the left compartment of the cubicle..
B51 is the coupling terminal for external connections such as operation functions and cooling fan supply. Terminal B51 is located at the bottom of the right compartment of the control cubicle.
Terminal B52, in the right compartment, consists of a number of plug in connectors for signal interchange between the control and thyristor cubicles. The control pulses for example, are transmitted to the thyristor cubicle via this terminal.

## Drive supervision and diagnostics

Tyrak XL convertors have an extensive system for status check, operational supervision and fault diagnosis. These functions combined give a high degree of availability, protect the drive equipment and the object driven and facilitate fault tracing, upkeep and operation.

The control equipment monitors the operation and reports abnormal conditions.

- Protective functions such as earth fault, overload, supervision of speed feedback etc.

- Switch-on and switch-off sequences are supervised and evaluated.

If a command is not acknowledged within a certain time, an error message is presented on the operator's panel display.

The error messages are presented in plain language with first-fault indication and consequential faults with time of occurrence in relation to the first fault.

The error text can be presented in Swedish, German, English or French.

### Error statistics

Each fault is allocated a consecutive number 1 - 99. Fault signals are stored in a RWM with voltage back-up and it is therefore possible, at any time, to return to investigate the circumstances of a particular fault. The complete fault list can also be printed via a separate printer.

### Logger

This function permits the recording of values from up to six optional signals at individually optional intervals. The log function stores 186 values per signal and the value stored is the mean value during the measurement interval. The signals can be shown graphically on the operator's panel. The function can be used to show trends in certain signals or provide a basis for the analysis of faults which have resulted in tripping of the drive. Signals logged can be used in commissioning, for example when trimming a speed controller.

# Thyristor cubicle

## General description

The main circuit contains the thyristor bridge, cooling fan, fast acting fuses and other protective functions for the main circuit.

The power components are designed to allow connection to supply voltages from 510 to 1190 V.

## Power supply

The main circuit connections at supply and machine side, as well as interconnections between thyristor cubicles, are done by cables from below.

## Thyristor bridge

The thyristor bridge (G1) is built up as a three phase, fully controlled 6-pulse coupling. It is available as a single convertor or as a double convertor. In the double convertor version, the thyristors are directly anti-parallel coupled with common fusing and RC-circuits.

### Trigger pulse transmission

The trigger pulses are conducted via shielded cables from the opto coupler units in the convertor control units in the control cubicle. From the opto coupler unit, the trigger pulses are conducted via a shielded cable to the pulse amplification unit (B15) in the thyristor cubicle. After galvanic isolation in pulse transformers, the gate pulses are conducted to the different thyristors. The trigger pulses can be measured via test terminals on the pulse amplifier board YXU 201A.

In single convertors, the trigger pulse amplifier is equipped with two circuit boards (YXU 201A + YXU 202A). In double convertors, there are two sets of circuit boards, one set for forward and one set for reverse direction.

### Current measurement

The d.c. current is measured on the a.c. voltage side of the thyristor unit with the help of two current transformers, pos. G1.35, 36 (37). The output signal is rectified in a diode bridge (pos.B13) and is adapted with load resistors on the current measuring board YXA 118 pos. Y2.B20. (B32). 8, so that the output voltage is 3,30 V at rated current (3,0 V with parallel bridges). If two thyristor bridges are connected in parallel, the current is measured in all three phases for each bridge. This is to enable the use of the asymmetry protection unit on the current measuring board YXA 118.

### Semiconductor fuses

The thyristors are protected by fast acting semiconductor fuses in the branches.

### Transient protection (A13)

The transient protection consists of six capacitors which are coupled to form three groups of two serial coupled capacitors. Each such group is coupled between one phase and earth. Each group is protected by a 1500 V 6 A fuse. The fuses, 1 - 3, protect the synchronizing voltage transformer (B8.1) and the earth fault protection unit (B30). The unit A13 also contains fuses for the DC voltage measuring unit (B26.2).

### Asymmetry protection

Current asymmetry protection is included in the basic equipment for all convertors in which two thyristor bridges are connected in parallel. The function of the protection is to indicate poor division of current between the parallel connected bridges, and thus hinder overloading of the thyristors. An error indication (and blocking) is obtained when one thyristor arm is loaded with a current which approaches its maximum permitted value and the parallel thyristor arm is loaded with significantly lower current.The current feedback from each thyristor bridge is compared in a current sensor unit placed on the current measuring board YXA 118 in the control cubicle.

An error indication can, for example, be obtained by reason of poor contact in one of the bus connections in the convertor, a trigger pulse error to a thyristor bridge or to a particular thyristor, a trip fast fuse for one or more thyristors or a malfunctioning thyristor.

Any fault that may occur is indicated on the operating panel at the same time as the convertor control orders phase retard and blocking.

### Current unbalance detection

In convertors with double bridges, both the a. c. and d. c. current is measured. The d. c. current is measured by means of a shunt in the the d. c. output. The d. c. current feedback is compared with the a. c. current feedback in the convertor control software. If there is a difference, the protection is activated. The aim of the unbalance detection is to give a quick detection if there is a difference between the input a. c. current and the output d. c. current, for instance if a circulating current between the forward and reverse thyristors has come up.

### Convertor fan

The thyristor bridge is cooled with a three-phase fan. The fan is D-coupled for 380 V 50 Hz or 440 V 60 Hz supply, and Y-coupled for higher voltages.

Cooling air is taken via the floor, or through louvres on the doors. Air outlet is through the roof.

If the convertor is connected to an anti-clockwise phase sequence, the connections to the fan must be changed to obtain the correct direction of rotation.

## Terminal units (B51, B52)

Terminal units B51 and B52 are located at the bottom of the apparatus compartment of the thyristor cubicle. Terminal B51 is used for power supply for the cooling fan. Terminal B52 consists of plug-in connectors for communication between the control and thyristor cubicles.

# Field exciter

The motor field circuit is supplied from a three phase digitally controlled field exciter, housed in a separate cubicle. At delivery, the field exciter is bolted on to the control cubicle as shown on dimension prints.

The field exciter consists of a main circuit breaker, thyristor bridge with current measurement, control unit, and a field discharge unit.
The field exciter communicates with the convertor control system via an optical serial link.

## Power supply

The field exciter is supplied by cables from below, connected to terminals at the bottom of the cubicle. The thyristor bridge is protected by a moulded case circuit breaker. The standard supply voltages are 380, 415, 440/460 and 500 V.

## Main circuit

The main circuit contains phase inductors, thyristor bridge, cooling fan, fast acting fuses, field discharge unit, and auxiliary power supply for the control equipment.

The thyristor bridge is built up as a three phase, fully controlled 6-pulse coupling. It is available as a single or double bridge. Thyristor blocks with two thyristors in each are used.
Phase fuses, RC-circuits and phase inductors are used as protection for the blocks.

### Trigger pulse circuits

The pulse transformers are assembled on a circuit board together with current measurement circuits and RC-circuits. The trigger pulses are generated in the control equipment and are transmitted to the thyristor bridge via a ribbon cable.

### Current measurement

The d. c. current is measured on the a. c. side of the thyristor unit with help of two current transformers. The output signal is rectified in a diode bridge and is adapted with load resistors so that the output voltage is 1,00 V at rated current.

### Convertor fan

Field exciters rated up to 115 A are provided with an axial fan powered with the operating voltage 110 V a. c. (M1).
Field exciters rated 195-515 A are cooled with a radial fan, supplied with 220 V a. c. (M1 - M2).