

## General

Tyrak Midi II convertors are designed in accordance with international standard IEC146, and meet the highest demands regarding performance, reliability and immunity to interference.

The control system is fully digital, from reference to trigger pulses. Both control procedures and sequential control functions are implemented digitally. Considerable emphasis has been placed on personnel safety. A powerful service unit simplifies commissioning, handling and fault tracing of the convertor.

## Convertor module

### Configuration

The convertor module includes a main circuit and a control equipment. The control equipment is common to all convertor modules while the main circuit differs with the current rating.

### Control equipment

The basic control system consists of three circuit boards, the processor board, YPQ201, the memory module, YPR201, and the I/O-board, YPQ202. The processor board and the I/O-board are mounted on opposite sides of a hinged panel, with the processor board facing front. The memory module is plugged in on top of the processor board. Space is provided on the panel for additional functions, four expansion I/O-units on the front, control unit for the digital field exciter on the back-side.

#### Processor board YPQ201.

A powerful microcontroller of type Motorola MC68332, running at 16 MHz is used. The operating system is monitored by diagnostic functions. The monitoring functions include a watch-dog, bus supervision, memory checking and power supply monitoring. In case of fault, a flashing fault code appears on a two digit LED display. The fault codes are explained in the fault tracing section. During normal conditions the CPU load is monitored and displayed.

Error signals and log values are stored in a RWM (Read Write Memory) with voltage back-up. It retains its contents for 12 hours following a power loss.

#### Memory module, YPR201

The function of the convertor is determined by the control program installed. The control program is stored in EPROM/EEPROM memory capsules on the memory module. A selection of standard memory modules are available, each delivered with a user manual with a functional description, signal and parameter list. For detailed description of the control program, refer to the user manual.

## Drive supervision and diagnostics

Tyrak Midi II convertors have an extensive system for status check, operational supervision and fault diagnosis. These functions, together, 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 signals and the value stored is the mean value during the measure-

ment 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.

## **Main circuit**

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

The power components are designed to allow connection to supply voltage up to 500 V or 660 V respectively.

## **Thyristor bridge**

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

Thyristor blocks with two thyristors in each are used in convertors with current rating up to 530 A. Phase fuses, RC-circuits and phase inductors are used as protection for these blocks.

Convertors with larger current ratings are provided with "puck" thyristors. These are protected with the help of semiconductor fuses in the branches.

## **Trigger pulse transmission**

The trigger pulses are conducted via a ribbon cable from the convertor control equipment to a pulse transformer board. After galvanic isolation in a pulse transformer, the gate pulses are conducted to the different thyristors. The trigger pulses can be measured via test terminals on the pulse transformer board. The test terminals are located on the primary side of the transformer i.e. separate from the main voltage.

In double convertors, the trigger pulses are coupled to the forward and reverse bridges with the help of electronic contacts on the pulse transformer unit. A green LED indicates that the forward bridge is conducting, a yellow LED for the reverse. This signal can also be measured at test terminals.

## **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. 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**

Convertors rated up to 120 A are provided with an axial fan powered with the operating voltage 110 V a.c. (M1).

Convertors rated 195 - 530 A are cooled with a radial fan, while convertors 640 - 1500 A are equipped with two axial fans for cooling. The supply is 220 V single phase M1 - M2.

Convertors rated 1530 - 3600 A are provided with a 3-phase fan. The fan is D-coupled for 380 V 50 Hz, 440 V 60 Hz and Y-coupled for higher voltages.

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.

## **Semiconductor fuses**

The thyristors are protected by fast acting semiconductor fuses. Convertors rated up to 530 A have the fuses in the incoming phases, while convertors with higher ratings have branch fuses.

## **Auxiliary power supply**

The auxiliary supply transformer, item 51, can be connected directly to 380 V, 415 V, 460 V and 500 V, 50 or 60 Hz and via an autotransformer, item 58, to 575 V and 660 V.

The transformer generates two 24 V voltages, designated Q1 and Q2. The microcontroller is supplied by Q1, while external circuits are supplied with Q2.

A high degree of immunity to interference is obtained with separate supply voltages. Each convertor's computer is directly grounded even in plants with a common reference system.

Both of the voltages are obtained from the same transformer, which is provided with screens between primary and secondary windings and between the two secondary windings. The transformer also contains a winding for synchronization of trigger pulses and for mains voltage monitoring.

The circuits are fused with miniature fuses, Q1 with 6.3 A and Q2 with 4 A fuses.