

# 200 kW Solid State MF Broadcast Transmitter TRAM 200



Datasheet

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#### Arrangement

Only eight 19" cabinets contain all components of the transmitter:

- Four amplifier cabinets
- Three filter cabinets
- One control cabinet

#### Amplifier

The amplifier section of the transmitter consists of two 100 kW power blocks, each made up of two 50 kW power blocks. Each 50 kW power block is contained in one 19" cabinet and equipped with 48 power modules. This power module is the basic unit of the RF amplifier. It supplies somewhat more than 1 kW into a special series transformer assembly (doughnut combiner) which summarises the power of all 96 power modules of the two 50 kW power blocks to the output power of one 100 kW power block. The outputs of the two 100 kW power blocks are combined in a star output combiner on top of the amplifier cabinets to the total transmitter power of 200 kW.

The power module is designed as one single printed circuit board, which is plugged into the assembly. The module comprises a switched RF amplifier bridge and an associated PDM modulator. Each unit supplies a completely modulated RF signal into the combining transformer. Thus in case of a module fault the service is maintained with only slightly reduced power but without reduction of quality performance.

#### RF Output Filter

The 200 kW output of the output combiner is connected to the input of the RF output filter which is contained in three 19" cabinets.

The transmitter is factory equipped for and tuned on the determined operation frequency. The coils of the output circuit can be tuned for the whole MF band, while the capacitors are determined for sub-ranges of this frequency band.

#### Drive and Signal Processing

The transmitter is equipped with a common drive unit (PLL synthesizer) and a common PDM processing unit for all power modules. A dual synthesizer assembly in passive standby configuration is available as an option. The RF drive can also be switched to an external frequency generator or synchronised from an external standard.

#### Power Supply

Mains input can be either from three-phase Medium Voltage which is appropriate for transmitters of higher power level, or from three-phase 400 V.

- Medium Voltage (MV) supply

The MV is supplied via an external MV switchgear to [one 0.21kV](#) three-phase cast resin multi winding transformer. Each transformer (D4xy5 4xd0) supplies four 50 kW power blocks.

The required 400 V / 230 V mains supply for the auxiliary equipment can be provided from an already existing 400 V station supply. Otherwise, an additional [0.4kV](#) transformer is necessary.

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- **Solution with 400 V Power Supply**

A common power supply, comprising one 400 V to 210 V three-phase transformer and two three-phase rectifier units, is provided for each 50 kW power block. Each rectifier unit is fed from an independent phase-shifted 210 V transformer output. This feeding provides 12-pulse ripple, only. The 400 V / 230 V feed also supplies the auxiliary equipment.

The four transformers are placed externally from the transmitter. As an option, we also provide a solution with one common external transformer having a special multi coil setup on the secondary side. In this case, the transformer supplies all four 50 kW power blocks.

The transformer(s) should be placed near the amplifier cabinets as to limit the lengths of the required cable connections.

#### **Cooling**

The components of the whole transmitter are basically air-cooled. A fan assembly located below each 50 kW power block moves the cooling air along the heat sinks of the power modules. This fan assembly compensates only the pressure drop inside the amplifier cabinet. The air is taken from the room and will be exhausted into the room.

Should external air ducts be required, an additional external blower system is needed to compensate the pressure drop in the external air ducts. Layout of the external air cooling system depends on the individual conditions at site.

Besides an air supply from below the cabinets or from the top, the transmitter layout with the rectifier transformers located externally from the amplifier cabinets does as an alternative allow the cooling air to be supplied to the cabinets from the side (in line with the transmitter axis).

#### **Control Section**

The control section of the transmitter comprises the 400 V / 230 V mains input, the internal distribution, the control panel with the components for local control and for metering as well as the remote control interface. Furthermore it comprises the common drive unit (PLL synthesizer) and the AF input unit with PDM processing.

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Amplifier configuration	Four individual 50 kW power blocks, each equipped with 48 individual power modules. Each power module comprises an RF amplifier and an envelope modulator. For each 50 kW power block, one further power module of the same type is employed as driver module. Always two 50 kW power blocks are connected in series to form 100 kW power blocks which are connected in parallel to 200 kW.
RF output power	200 kW carrier power Typical > 160 kW DRM power with external TRANSRADIO DRM Exciter
RF power reduction	Two preset power levels P1 and P2 (P1 adjustable from 50% to 100%, P2 adjustable from 25% to 50%)
Frequency range	525 kHz to 1710 kHz The TX will be equipped for and tuned on the determined operation frequency in factory (components for other frequencies on request)
Frequency stability	Deviation < $\pm 2$ ppm Input for external synchronization (selectable 1 / 2 / 5 / 10 MHz)
Operation modes	AM (A3E) DCC mode DAM (X3E) or AMC/EAMC (selectable by jumper setting) DRM with external TRANSRADIO DRM Exciter
RF output connector	4-1/2" EIA
Load impedance	50 Ohm unbalanced
Load VSWR	Max. 1.3 VSWR > 1.3: Automatic RF power reduction VSWR > 1.5: Automatic RF power shutdown
Out-of-band emissions	According to ITU-R SM.328-10
Spurious & Harmonics	According to ITU-R SM.329-8 ( $\leq 50$ mW from 9 kHz to 1 GHz)
Modulation system	Pulse Duration Modulation (PDM)
AF input	600 Ohm balanced (can be changed inside the unit to $\geq 2000$ Ohm) Adjustable from - 10 dBu to + 10 dBu referred to 100% modulation
AF range	30 Hz to 10 kHz Two audio lowpass filters available (4.5 kHz / 6.75 kHz)
AF response	$\pm 0.5$ dB (30 Hz to 10 kHz) with band limiting filters switched off
AF harmonic distortion (THD)	$\leq 1\%$ at 80% modulation
Modulation capability	100% continuously, 125% peak program capability (> 125% on request)
Carrier shift (amplitude drop)	$\leq 1\%$
Signal-to-noise ratio	$\geq 60$ dB referred to 100% modulation

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# LV power supply	3N 400 V, TN-S resp. TN-C mains configuration (5-wire resp. 4-wire)
# MV power supply	3~ MV, TN-S resp. TN-C mains configuration (5-wire resp. 4-wire) 3N 400 V, TN-S resp. TN-C mains configuration
Mains frequency	50 Hz (60 Hz on request)
Permissible voltage variation	$\leq \pm 5\%$ with full performance $\leq \pm 10\%$ with minor performance degradation
Power factor	$\geq 0.95$
Power consumption	$\leq 229.9$ kW at no modulation $\leq 344.8$ kW at 100% modulation
Overall efficiency	$\geq 87\%$
Metering	Pointer meters for currents and voltages of the power amplifier section Crosspointer meter for RF output power and VSWR Terminal for external second crosspointer meter available
Local control	Local / Remote, Transmitter On / Off, PDM On / Off RF power P1 / P2, Mode AM / DAM Audio lowpass filter On / Off Audio lowpass filter 4.5 kHz / 6.75 kHz LEDs for status indication Clear fault
Remote control interface	Parallel interface with floating contacts Ethernet interface with HTML web server and SNMP (Option) Serial interface RS 232 (Option)
Environmental temperature	- 10° C ... + 45° C
Relative humidity	Max. 90% (non-condensing)
Installation altitude	Max. 2000 m above sea level (higher altitudes on request)
Cooling system	Air cooling with internal fan assemblies below the power blocks External blower system with filtering and air ducts Cooling air consumption approx. 13200 cbm / h
Dimensions	WDH = 4800 mm x 1000 mm x 2600 mm

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### Schematic Diagram TRAM 200

