

EDS500 series - FSK modems

Datasheet 500FSD20



- Voice frequency telegraphy device (VFT)
- Power supply 24...60 V DC
- Channel frequency and bandwidth are selectable according to CCITT standards (R.35...R.38 or V.23/ 1200 Baud)
- Additional 600 baud or 2400 baud channels

Application

The 500FSD20 modem is designed for the operation on telecontrol communication lines. It is interoperable with RTU500 and standard-compliant 3rd party equipment. However it can also be connected to other data terminal equipments because it operates at the interfaces like a universal FSK-modem in the voice-band range (300-3400 Hz) according to CCITT.

The 500FSD20 modem allows the assignment of a two- or four-wire line with communication channels of 50 baud up to 2400 baud (24 channels 50 baud, 12 channels 100 baud, 6 channels 200 baud, 2 channels 600 baud, 1 channel 1200 baud).

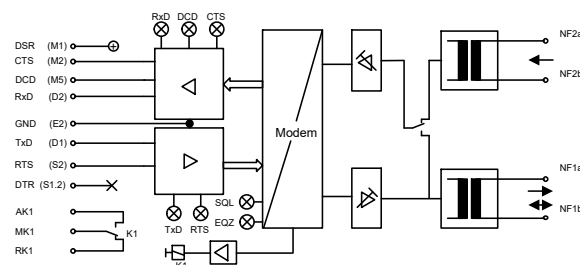


Figure 1: Block diagram 500FSD20

Characteristics

A high-resistance staggering is possible with the 500FSD20 modem on multi-drop lines. Full- and half-duplex operation is possible without special additional provisions like hybrid termination circuit according to channel assignment and selected two wire or four-wire

line. It is designed for the transfer characteristics of local-cable-wires.

A digital signal processor (DSP) is responsible for the conversion of the binary information into the voice band and vice versa. Its high processing capacity allows beside others a high selective channel filtering (90 dB) and thereby an unrestricted channel assignment.

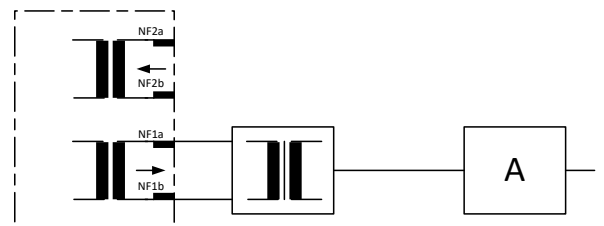


Figure 2: Half duplex two-wire link with common transmitter and receiver link

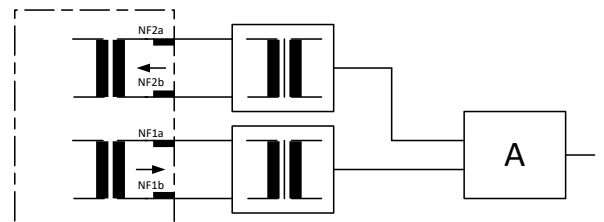


Figure 3: Duplex four-wire link with separate transmitter and receiver link

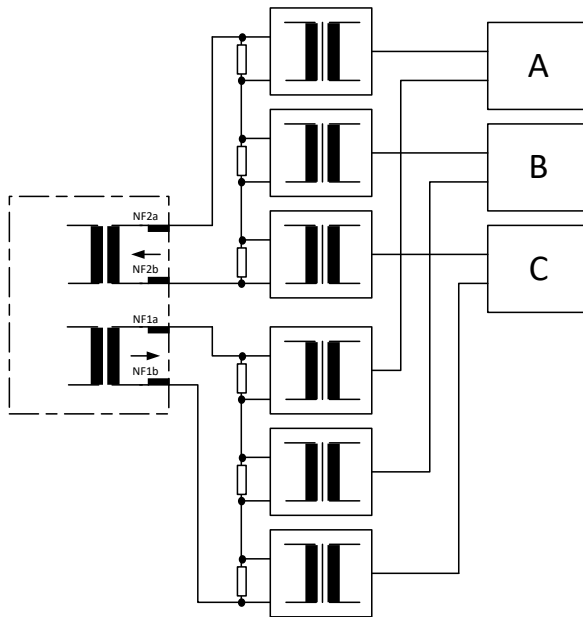


Figure 4: Point-to-point star-coupling of up to three telecontrol lines to 500FSD20 modem on four-wire-links

The channels can be assigned in the CCITT raster. Transmitter and receiver can be configured to different baud rates for transfer rates of up to 600 baud. If all channels should be used in any combination and baud rate, the high channel selectivity option is to be configured. The normal selectivity can be used if separate assignment of transmit and receive channels (block configuration) and at least one unused channel between the blocks is used. A lower transfer time and isochronous distortion is given at normal selectivity.

The 500FSD20 modem can monitor the received signal for isochronous distortion and indicate an error condition by the "signal quality level (SQL)" alarm if a limit is exceeded (40% resp. 50%) repeatedly (10x). The LED SQL indicates for at least four seconds, at greater interferences accordingly longer, the exceeding of the maximum distortion.

Detected errors are signalized by a red Error LED (labeled Alarm) together with an alarm condition. The alarm condition can also be signalized by an isolated alarm relay. The conditions that lead to an alarm state can be configured.

An existing configuration can be saved as well as restored. The configuration can also be stored to an external configuration stick (500NMA01), which supports the simple exchange of a device without trained personnel. The configuration stick is connected to the extension jack labeled EXT.

The audio-frequency carrier is monitored and indicated respectively alarmed by the DCD signal. For multi-drop lines, a carrier drop-out can be signalized with a delay by the alarm relay. The delay time depends hereby on the baud rate. The alarm relay of the modem can be configured to respond at carrier drop-out (DCD direct or delayed), at SQL alarm, or at supply voltage failure.

To compensate line distortion on critical transmission links the 500FSD20 modem offers the possibility of an adjustable pre-distortion. Depending on the quality condition of the transmission link this pre-distortion can be set to high or low pass mode between 0 and 10 dB.

The two 500FSD20 modems of a transmission link can be configured for test mode to adjust the correct pre-distortion. The utilized result of the transmitted test pattern is indicated by the LED EQZ, where the flashing frequency is a degree for the achieved improvement.

The 500FSD20 modem allows to connect up to three transmission lines star-coupled as point-to-point link without repeater. The transmitter output circuit operates hereby as constant current source.

All essential settings like channel, gain, line operation mode, line termination, transmission rate etc. are configured by software and stored in the internal memory. Configuration is done via the serial interface (Con0). The RS-232 interface is configured to baudrate 57600, 8 databits, no parity, 1 stopbit (57600, 8N1). The command-line interpreter for configuration via this interface can be accessed by any terminal software (e.g. Hyperterminal).

The 500FSD20 has a built-in overvoltage protection (OVP) against transient voltages. The isolation level of the communication line is 3 kV. Additional low frequency (LF) signal transformers have to be used if higher isolation voltages are required.

Technical data

In addition to the EDS500 series general technical data, the following applies:

General Data	
Type of modulation	Frequency shift keying (FSK) with carrier switch-off for multi-drop network
Type of communication	Point-to-point or multi-drop network
Operation modes	Full- or half-duplex via two-/four-wire links
Channel assignment	<ul style="list-style-type: none">according to CCITT raster (R.35, R.37, R.38A, V.23/1200 baud)additional options: 600 baud or 2400 baud channel

General standards	
Safety tested according to	<ul style="list-style-type: none">IEC 62368-1
Environmental conditions tested according to	<ul style="list-style-type: none">ETSI EN 300 019-1-3 class 3.4IEC 60255-21-1 class 1IEC 60255-21-2 class 1IEC 60255-21-3 class 1EN 50125-3 class T1 and T2
Electromagnetic compatibility (EMC) tested according to	<ul style="list-style-type: none">IEC 61000-6-1IEC 61000-6-2IEC 61000-6-3IEC 61000-6-4ETSI EN 300 386EN 50121-4
Insulation classification according to	IEC 60664-1 <ul style="list-style-type: none">Pollution degree 2Overvoltage category IIAltitude: ≤ 3,000 m

Environmental conditions - climatic	
Operating temperature EN 60068-2-1, EN 60068-2-2, EN 60068-2-14	-40 °C ... 80 °C
Relative humidity EN 60068-2-30	5 ... 95 % (non condensing)
Railway applications EN 50125-3	climatic class T1 and T2

Environmental conditions - mechanical

Vibration sinusoidal, Test Fc, IEC 60068-2-6	3 mm (3 ... 9 Hz)	
	10 m/s ² (9 ... 200 Hz)	
	1 octave/min, 10 cycles per axis ETSI EN 300 019-1-3 class 3.4 IEC 60721-3-3 class 3M5	
	3.5 mm (3 ... 9 Hz)	
	10 m/s ² (9 ... 35 Hz)	
	1 octave/min, 1 cycle per axis IEC 60255-21-3 class 1	
	3 mm (3 ... 9 Hz)	
	10 m/s ² (9 ... 200 Hz)	
	15 m/s ² (200 ... 500 Hz)	
	1 octave/min, 10 cycles per axis IEC 60870-2-2 class Bm	
	0.035 mm (10 ... 60 Hz)	
	5 m/s ² (60 ... 150 Hz)	
	1 octave/min, 1 cycle per axis IEC 60255-21-1 class 1	
	Shock and Bump, Test Ea, IEC 60068-2-27	50 m/s ² , 30 ms
		3 shocks per direction
	250 m/s ² , 10 ms	
	4 shocks per direction IEC 60721-3-3 class 3M5	
	150 m/s ² , 11 ms	
	3 shocks per direction IEC 60255-21-2 class 1 IEC 60870-2-2 class Bm	
	100 m/s ² , 16 ms	
	1000 shocks per direction IEC 60255-21-2 class 1	

Emission test

Radiated emissions - enclosure ports (30 Mhz to 1 GHz), CISPR 16-2-3/ EN 55016-2-3	EN 55022/ CISPR 22 class B
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Immunity test

Electrostatic discharge, IEC 61000-4-2	8 kV air / 6 kV contact (level 3), criterion A
Radiated radio-frequency electromagnetic field, IEC 61000-4-3	80 MHz to 1 GHz: 20 V/m (level x), criterion A
	1 GHz to 2.7 GHz: 10 V/m (level 3), criterion A
	2.7 GHz to 6 GHz: 10 V/m (level 3), criterion A
Power frequency magnetic field, IEC 61000-4-8	100 A/m (level 5), criterion A
Impulse magnetic field, IEC 61000-4-9	300 A/m (level 4), criterion A

Mean time between failure (MTBF)	
Calculation according to Telcordia II 40°C	112 years @ 40 °C

Mechanical layout	
Dimensions	99 x 45 x 115 mm (H x W x D)
Housing type	Plastic housing
Mounting	DIN rail mounting (EN 50022 TS35: 35 mm x 15 mm or 35 mm x 7.5 mm)
Cooling	thermal convection (no moving parts)
Enclosure protection class	IP20
Weight	230 g

Power supply input (X1)	
Operating voltage	24-60 V DC -15%/ +20%
Power consumption (typical)	3 W
Current demand (peak)	180 mA
Circuit classification	ES2 (acc. IEC 62368-1)
Plug type	Phoenix Contact MSTBT 2,5/3-ST
Galvanic isolation	1.5 kV isolation voltage
Reverse polarity protection	yes
Overvoltage protection	line to earth ± 4 kV, line to line ± 2 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV line to earth, 2 kV line to line (level 4), criterion A
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Conducted emissions - asymmetrical DC ports, common mode (0.15 MHz to 30 MHz), CISPR 16-2-1/ EN 55016-2-1	EN 55022 / CISPR 22 class B

Serial interface to DTE (X2)		
Electrical specification	ITU-T V.24, EIA RS-232, EIA/TIA-561	
Signal definition	V.24	V.28
Signal lines	TxD D1	103
	RxD C2	104
	RTS S2	105
	CTS M2	106
	DCD M5	109
	DTR S1	108.2
	DSR M1	107
Plug type	RJ-45 (8P8C)	
Cable	shielded RS-232 cable, up to 3 m	

Serial interface to DTE (X2)	
Adapter cable	500CAB08 1KGT038915R0001: RJ45 to SubD9F (SWT-RS232), shielded
Circuit classification	ES1 (acc. IEC 62368-1)
Galvanic isolation	no
Overvoltage protection	shield to earth 4 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV (level 4), criterion A
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	2.5 kV (level 3), criterion A
Ring wave, IEC 61000-4-12	
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV (level 3), criterion A

Interface to transmission line (X3)	
Electrical specification	ITU-T R and V series
Input- / Output impedance	600 Ω non earthed and symmetrical, or 5 k Ω at stagger operation
Transmission level at 600 Ω	0... -22.5 dBm configurable by software, depending on bit rate (CCITT) or number of used channels
Transmitter pre-distortion	high- or low-pass 0... 10 dB
Receiver level range	0... -58 dBm
Sensitivity	0/ 6/ 10/ 14/ 26 dB
Receiver filter characteristic	configurable between high (90 dB) and normal selectivity (for 50...600 baud)
Circuit classification	ES2 (acc. IEC 62368-1)
Plug type	Phoenix Contact MSTBT 2,5/4-ST
Galvanic isolation	3 kV isolation voltage
Overvoltage protection	line to earth ± 4 kV, line to line ± 2 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV line to earth, 2 kV line to line (level 4), criterion B
Surge 10/700 μ s, IEC 61000-4-5	2 kV line to earth, 1 kV line to line (level 3), criterion B
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A

Interface to transmission line (X3)	
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Conducted emissions - symmetrical network ports (0.15 MHz to 30 MHz), CISPR 16-2-1/ EN 55016-2-1	EN 55022/ CISPR 22 class B

Serial interface (Con0)	
Electrical specification	ITU-T V.24, EIA RS-232
Data rate	57.6 kbps, 8 data bits, no parity, 1 stop bit
Plug type	RJ-12 (6P6C)
Cable	shielded RS-232 cable
Adapter cable	500CAB06 1KGT038912R0001: RJ12 to SubD9F (DTE-PC)
Circuit classification	ES1 (acc. IEC 62368-1)
Galvanic isolation	no
Overvoltage protection	shield to earth 4 kV
Ring wave, IEC 61000-4-12	2.5 kV (level 3), criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV (level 3), criterion A

Extension connector (EXT)	
Connector	proprietary
For usage of the configuration stick 500NMA01 to save the configuration to an external media.	

Alarm output (X4)	
Type of switch	toggle (potential free)
Switching voltage	60 VDC / 25 VAC
Switching current	500 mA
Plug type	Phoenix Contact MSTBT 2.5/4-ST (item no. 1779851)
Circuit classification	ES1 (acc. IEC 62368-1)
Overvoltage protection	line to earth ± 4 kV, line to line ± 2 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV line to earth, 2 kV line to line (level 4), criterion B
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Ring wave, IEC 61000-4-12	2.5 kV line to earth, 1 kV line to line, criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV / 1 kV (level 3), criterion A

Alarm output (X4)	
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A

Signal quality level monitor	
Threshold for error	isochronous distortion: <ul style="list-style-type: none"> >40% for 50...1200 baud >50% for 2400 baud
SQL - LED	ON: >10 errors with <4 sec distance OFF: no errors for at least 4 sec

DCD monitoring	
DCD alarm at half duplex operation	If the carrier is lost for a minimum of n seconds: <ul style="list-style-type: none"> 16 sec for 50 baud 8 sec for 100 baud 4 sec for 200 baud 2 sec for 600... 2400 baud
DCD alarm at duplex operation	Switches with carrier directly, operation mode configurable
DCD - LED	Switches with carrier directly

Ordering information	
500FSD20 R0001	1KGT039200R0001

Accessories ordering information 500NMA01 configuration adapter	
500NMA01 R0001	1KHW027870R0001

Accessories ordering information 500CAB03 RS-232 adapter cable 250 cm RJ12 to SubD9F (DTE-PC)	
500CAB03 R0001	1KGT038909R0001

Accessories ordering information 500CAB06 RS-232 adapter cable 120 cm RJ12 to SubD9F (DTE-PC)	
500CAB06 R0001	1KGT038912R0001

Accessories ordering information 500CAB08 Modem 50-2400 baud	
500CAB08 R0001	1KGT038915R0001

Data table								Dimension	
Data format	serial, binary, asynchronous								
Traffic mode	Point-to-point, multidrop								
Modulation type	Frequency shift keying (FSK) with carrier switch-off for multidrop networks								
CCITT channel	R.35	R.37	R.38A	600 bd	V.23	2400 bd			
Bit rate nominal	50	100	200	600	1200	2400	bd		
Minimum channel distance	120	240	480	1440			Hz		
Mid-frequency	lowest	420	480	600	1320	1700	2000	Hz	
	highest	3180	3120	3000	2760	1700	2000	Hz	
Frequency deviation	± 30	± 60	± 120	± 210	± 400	± 400	Hz		
Number of channels according to CCITT	24	12	6	2	1	1			
Transmitter level according to CCITT	-22.5	-19.5	-16.5	-12.0	-8.7	-6.0	dBm		
Transmitter level depending on used channels [used channels: level / used channels: level]	1: -6/ 2: -9/ 3: -12/ 4: -12/ 5: -13.8/ 6: -13.8/ 7...9: -15.6/ 10...13: -17.2/ 14...18: -18.6/ 19...24: -19.8						dBm		
Receiver sensivity (RS)	0/ 6 / 10 / 14 / 26						dB		
Minimum receiving level at 14 dB RS	high selectivity	-50	-48	-46	-51	-55	-46	dBm	
	norm. selectivity	-53	-53	-52	-51	-55	-46	dBm	
Channel transfer time	high selectivity	43	26	15	6,7	3,5	3,1	msec	
	norm. selectivity	36	19	11	6	3,5	3,1	msec	
Isochronous distortion	high selectivity	1-3	4-8	8-13	5-7	7-11	18-24	%	
	norm. selectivity	0-2	0-2	0-2	5-6	7-11	18-24	%	
Channel delay time RTS = ON to DCD = ON	high selectivity	minimum	58	36	21	9	---	---	msec
		maximum	85	50	29	14			msec
	normal selectivity	minimum	46	24	14	7	6	6	msec
		maximum	65	35	19	10	9	7,5	msec
Channel delay time RTS = OFF to DCD = OFF	high selectivity	minimum	50	28	16	6	---	---	msec
		maximum	74	46	27	12			msec
	normal selectivity	minimum	40	20	12	6	3	3	msec
		maximum	54	30	16	8	7	7	msec

Table 1: Technical data for the channels