

D4. 0102

C.I - 502

I / F S P E C I F I C A T I O N

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1 GENERAL

The CI-502 is an interface module between the KS-502 bus and four half/full duplex asynchronous communication channels.

The CI-502 is a passive module.

2 COMMUNICATION INTERFACE

The CI-502 module contains data registers and control logic for controlling four full or half duplex asynchronous serial communication channels, in a "current loop" mode. The interface has in addition, line drivers/receivers for communication in accordance with the data interchange circuits specified by the V24 recommendations. TTL compatible, open collector, outputs are also available.

2.1 Input Data

The input data is shifted serially into a Universal Asynchronous Receiver/Transmitter (UART) where start-stop and control bits are detected, and where data in parallel form (5 or 8 bits) are transferred to a holding register included in the UART.

The data word length is selectable by straps for 5, 6, 7 or 8 bits and one (1) or two (2) stop bits.

If straps are not mounted, the word length will be (8) eight bits and the number of stop bits will be (2) two.

The input data is transferred to the KS-500 bus by an I/O instruction (see 2.5).

2.2 Output Data

The output data is transferred from the KS-500 bus to an eight bit holding register.

From the holding register, the (8) eight bit data word is transferred to one of four UARTS, from where the data word is transmitted serially. Start and stop bits are appended as well as an odd or even parity bit (if strapped for parity).

Without strapping, one start bit, eight data bits and two stop bits are automatically selected. With strapping, 5, 6, and 7 bit data words may be selected, as well as one stop bit, and parity check and generation. The output data is transferred to the CI-502 on the KS-500 bus by an I/O instruction (see 2.5)



2.3 Data Bit-Rate Selection

The CI-502 contains circuitry to allow selection of data transmission/receiving speeds independently for each of the four (4) channels. The bit rates are 50, 75, 110, 134/5, 150, 200, 300, 600, 1200, 1800, 2400, 4800 or 9600 bits per second, program selectable.

One Device Code Number (DVN) for each channel is used to transfer the respective channel bit rate information (see 2.5.2).

2.4 Signal Lines

2.4.1 Current Loop Data is transmitted as rate controlled "breaks" (marks and spaces) in current (20 mA) loops, and isolated from computer ground by optical-electrical drivers. Received data are in the same manner, pulses from the peripheral device are also isolated from computer ground through optical-electrical receivers.

The Current Loop I/F can be adapted to a 4-wire (full duplex) or a 2-wire (half duplex) operation.

The Current Loop I/F is zener diode protected against a maximum of 30 volts. Maximum withstanding isolation voltage is 300 volts.

2.4.2 V.24 Modem I/F - The electrical characteristics for the interchange circuits in this mode of operation will be adhered to by using EIA RS-232C line drivers and receivers. (Motorola MC-1488 and 1489 AL, or equivalent.)

The following interchange circuits are:

- Transmitted Data (103)
- Received Data (104)
- Device Ready (118) or (107) see 2.4.3

The data signals are considered in a marking condition when the voltage is more negative than minus three (-3) volts with respect to signal ground and in a spacing condition when the voltage is more than plus three (+3) volts with respect to ground. During transmission of data, a marking condition will denote a binary "one" and a spacing condition a binary "zero". The normal condition on a data circuit when no signals are present, will be "marking". A spacing condition when no signals are present can be selected by means of a strap.

The maximum open-circuit voltage between ground and any interchange circuit shall not exceed 25 volts.



2.4.3 Miscellaneous Lines - Device Ready (Busy) - Four Device Ready circuits are available, one for each channel. These circuits are isolated from computer ground through the use of optical-electrical receiver in current loop mode. OR-ed with the current loop circuits is one for each channel V.24 circuit. With a positive input (more than +3V) the input is READY.

2.4.4 Cable Lengths - The cable lengths for the 20mA current loop interface shall be limited to and not exceed the guidelines in Table I, assuming the driving voltage is 20 volts (the table is approximate only for voltages lower than 20 volts. For less than 20 volts but greater than 10 volts, the electrical environment (noise, etc) must be taken into consideration and cable lengths kept to a minimum.

Bits per second	Cable length (meter) (shielded twisted pair - 0.4 mm ² dia. wire)
110	4000
300	3000
600	1500
1200	400
2400	300
4800	100
9600	60

TABLE I - Current Loop Cable Length guidelines.

NOTE: The CI-502 is designed for a standard current loop driving voltage of 20 volts. When other voltages are utilised the current limiting resistor must be changed.

The V.24 modem I/F cable should be kept to under 15 meters.

2.5 KS-500 Bus Interface

All signal lines connected to the KS-500 bus are according to the requirements specified in the "KS-500 BUS SPECIFICATION" (D4.0045). During the data cycle the RUN signal will be delayed for about 0,5 μsec.



2.5.1 I/O Control of Data

The I/O control for data handling accepts all instructions listed in Table II and described in the KS-500 Programmers Instruction Manual.

OP.CODE	MNEMONICS	DESCRIPTION
160 000	IOIS (SNI)	I/O INTERRUPT SENSE
160 400	IOA	I/O ACTIVE
161 000	IOS	I/O SKIP IF DEVICE READY
161 400	IOT	I/O X-FER AND SKIP IF DEVICE READY
162 000	IOPI	I/O PREPARE INTERRUPT
163 000	IODI (DPIN)	I/O DISABLE INTERRUPT

Table II - I/O Instructions - Data

NOTE: IOAP and IOTP are not to be used.

2.5.2 I/O Control of Bit-Rate Selection

The I/O control for bit-rate selection accepts the instructions listed in Table III.

OP.CODE	MNEMONICS	DESCRIPTION
160 400	IOA	I/O DATA TRANSFER
161 000	IOS	I/O SKIP
161 400	IOT	I/O DATA TRANSFER AND SKIP

TABLE III - I/O Instructions - Bit-Rate Selection

2.5.3 Device Number Selection:- Device numbers will be selected through the grounding of appropriate DS3-DS7 lines on the back-wiring.

With DS3-DS7 not grounded, the four full duplex communication channels (CI-502) will assume the following device numbers:

Input	Output
Channel 1 50	250
2 51	251
3 52	252 Data
Channel 4 53	253
Channel 1	254
2	255 Bit-Rate
3	256 Information
Channel 4	257



2.5.4 Output Data Words

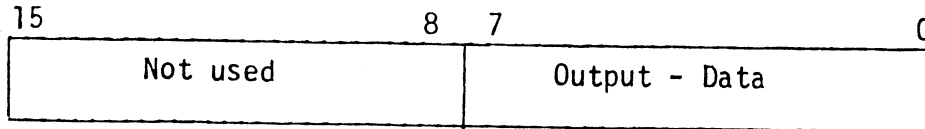


Fig. 2 - Output data word format.

Figure 2 shows the format of the output data word, as used by CI-502.

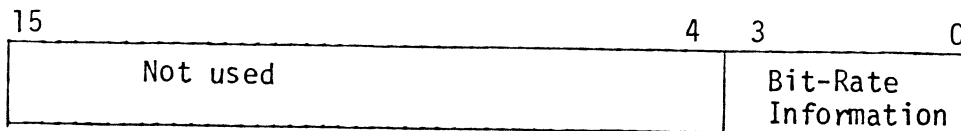


Fig. 3 - Output Bit-Rate Information word.

Figure 3 shows the Bit-Rate Information output word.

Table IV shows the corresponding bit-rates versus the output word bit-configuration.

Bits 3 2 1 0	Bit-Rate
0 0 0 0	NOT USED
0 0 0 1	NOT USED
0 0 1 0	50
0 0 1 1	75
0 1 0 0	134,5
0 1 0 1	200
0 1 1 0	600
0 1 1 1	2400
1 0 0 0	9600
1 0 0 1	4800
1 0 1 0	1800
1 0 1 1	1200
1 1 0 0	2400
1 1 0 1	300
1 1 1 0	150
1 1 1 1	110

TABLE IV - Bit-Rates



2.5.5 Input Data and Status Word

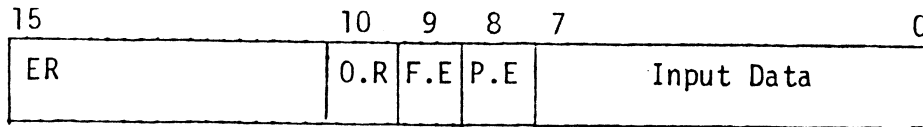


Fig. 4 - Input Data and Status word format.

Error conditions such as:

- Parity error (P.E)
- Framing error (F.E)
- Overrun (O.R)
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are detected and presented to the processor as discrete bits in the input data word. To simplify the detection of these bits by the software, bit 15 (16th bit) will be set to a "one" value, indicating the presence of an error condition.

2.6 Board Layout

In accordance with the KS-500 specification.

2.7 Environment Specification

In accordance with "SPESIFIKASJON FOR KRETSKORT KS-500 FORMAT".

2.8 Program Examples

Input one character from a teletype connected to channel 1:

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LDA      =@000017      BIT RATE = 110
IOA      @ 254         OUTPUT BIT RATE TO CHANNEL 1
LDA      =@003400     MASK FOR ERROR BITS
COPY     A,T
IOT      @ 50         INPUT CHARACTER
JMP      * - 1        WAIT UNTIL READY
COPY     A,D         SAVE CHARACTER
RAND     T,A         MASK OUT ERROR BITS

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JAF	ERROR	CHECK IF ERROR
COPY	D,A	UNSAVE CHARACTER
STA	INBUF,X	STORE WHEN OK

Output characters in an OUTBUF to a teletype connected to channel 1:

	LDA	= @ 000017	BIT RATE = 110
	IOA	@ 254	OUTPUT BIT RATE TO CHANNEL 1
OUTPUT	SAX	-5	NUMBER OF DOUBLE CHARACTERS
	LDA	OUTBUF +5,X	
	SLRA	8	ROTATE TO CORRECT POS
	IOT	@ 250	OUTPUT CHARACTER
	JMP	* - 1	WAIT UNTIL READY
	SLRA	8	ROTATE TO CORRECT POS
	IOT	@ 250	OUTPUT CHARACTER
	JMP	* - 1	WAIT UNTIL READY
	JNC	OUTPUT + 1	JMP UNTIL ALL OUTPUT
	JMP	OUT	FINISHED