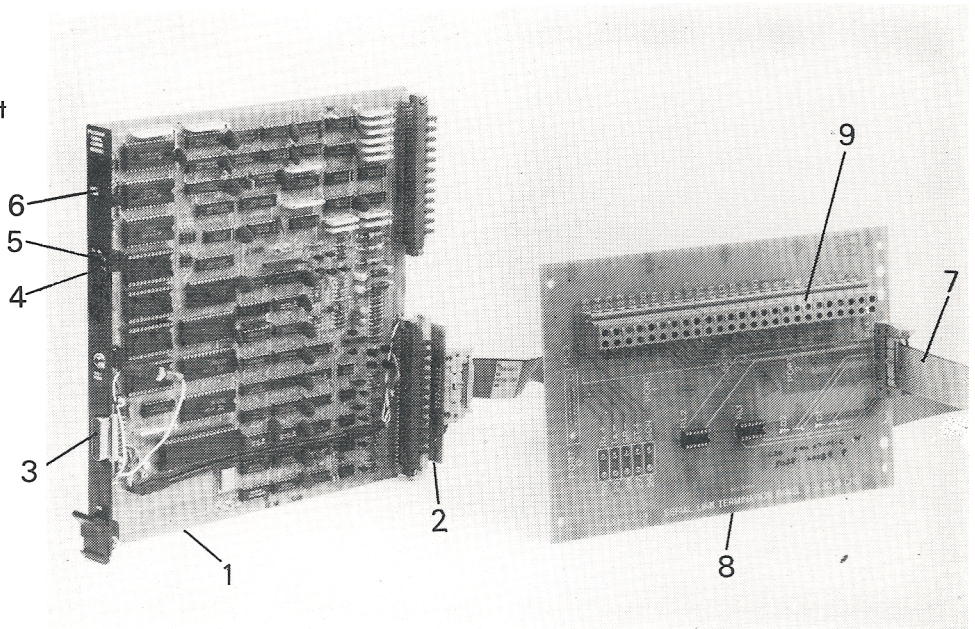


PROGRAMMABLE SERIAL COMMUNICATIONS 8847

1. Module type 8333, takes one slot in fast I/O subrack.
2. Backplane type 8503 or 8504.
3. Connector for programming.
4. Tx & Rx activity lamps for user's serial link.
5. Programmer activity lamps.
6. Battery warning lamp.
7. Ribbon cable (20 or 34 way).
8. Termination panel type 8038 (illustrated) or 8035.
9. Terminals for user cabling.



Description

The programmable serial communications facility, called COMMUNE, provides an asynchronous serial link which may be programmed by the user to construct a serial link to a computer, or peripheral device, or virtually any micro processor based proprietary equipment which has a serial port.

The programming language is a subset of BASIC, with extensions which make the handling of the serial port very easy. The system may be programmed in the field using a standard GEM80 programmer. The program is stored in on-board battery supported CMOS RAM, with facilities for magnetic tape load/dump/verify.

The equipment consists of a single width module, backplane, ribbon cable and termination panel, and can be installed in any GEM80 controller with a Fast I/O highway.

Features

- Protocol to suit the application.
- Easy to program in BASIC language.
- Variable signalling rate 110 bits/s to 9600 bits/sec.
- Full or half duplex with message checking.
- Choice of 20mA current loop, or RS232C (V24/V28) with modem control signals.
- Software configurable character format and signalling rate.

Specification

Number of ports
1 for user serial link. (2nd port for programming only)

Type of serial link
Asynchronous only.
20mA or RS232C (V24/V28).
110 to 9600 bit/s.
Half or full duplex.

Character format
5, 6, 7 or 8 data bits.
Odd, even or no parity.
1 start bit.
1, 1.5 or 2 stop bits.

Link protocol
Programmed by user.

Message checking

CRC options $X^{16} + X^{15} + X^2 + 1$
or $X^{16} + X^{12} + X^5 + 1$ or longitudinal
parity or other check implemented
in COMMUNE user program.

Programming

Programming language

Subset of ANSI BASIC, with
extensions for serial port and string
handling. Simple 16 bit integer
maths.

User program capacity

3595 bytes of battery supported
CMOS RAM for program,
dynamically allocated arrays and
string variables.

Interface with host controller

31 input and 31 output words
available for user.
1 input word reserved for
diagnostics.

Memory Support

Type

Non-rechargeable lithium-
copper-oxide battery mounted on
module.

Battery life

4 years typical, 1.5 years minimum
(continuous support with power
off)

Battery shelf

10 years typical, 5 years life
minimum (battery isolated or main
power on).

20mA Current Loop External Interface

Current sources

2 off 20mA $\pm 15\%$, driven from $\pm$
15V supplies.
Compliance up to 20V.

Data output

Optically isolated 20mA switch,
conducting for MARK (idle
condition).
Volt drop $< 1.2V @ 20mA$.
Leakage $< 1mA @ 30V$.

Data input

Optically isolated 20mA sensing
load.
 $< 3mA$ for SPACE (break
condition).
15mA to 25mA for MARK (idle
condition).

Common mode

$\pm 30V$ max.

RS232C/V24 External Interface

Circuit Function

SG	Signal ground common return
TXD	Transmit data from COMMUNE
RXD	Data received by COMMUNE.
RTS	Request to send. Output from COMMUNE user program.
CTS	Clear to send. Input to COMMUNE user program and hardware enable for transmit.
DSR	Data set ready. Input to COMMUNE user program.
DTR	Data terminal ready. Output from COMMUNE user program.
SIG.DET	Data channel received line signal detector, must be on to gate RXD data into input buffer for COMMUNE.

Signal levels:-

Positive =

Logic 0 = Control ON = SPACE

Negative =

Logic 1 = Control OFF = MARK

Logic 0

Input + 3V to + 15V

Output + 5V to + 15V

Logic 1

Input - 3V to - 15V

Output - 5V to - 15V

Load

Input 4K Ω nominal

Output 3K Ω to 7K Ω

Power Consumption

Power consumed from host controller

1.3A @ +5V

40mA @ +15V

20mA @ -15V

Plus 20mA @ $\pm 15V$ per 20mA source used.

Front Panel Indicators

Transmit and receive lamps (yellow) for port 1 (user's port) and port 2 (programming), on for link activity. Pulse stretcher makes short bursts visible.

Battery warning lamp (red) on for low battery voltage.

Mounting Details

Module

Occupies one slot on fast I/O highway.

Mech. coding (module)
Upper 3U, 6U.
Lower 1L, 2L.

Termination panel (8035 or 8038)
156 x 239 x 30mm (high x wide x deep)
Rack mounting, half rack width on two mounting channels type 8959 at 222mm centres.

Environment

Temperature
0 to 60°C operating.
-20 to 70°C storage.

Environment and tests
GEM 80 standard.

Application Notes

1. Choice of 20mA or RS232C/V24

1.1 Facilities provided

The serial communications module type 8333 contains the interface circuits for both 20mA current loop and RS232C (V24/V28) voltage level interfaces.

Because of the optical isolation, the 20mA option is more tolerant of earth voltage differences than RS232C. 20mA working also provides better immunity to noise pick-up. It is recommended that 20mA working should be adopted for any link which exceeds a few tens of metres in length.

20mA working provides a capability for multi-drop working which is not available using an RS232C interface.

1.2 20mA option

The 20mA current loop convention uses nominal 20mA flowing for logic 0 (idle condition) and nominal zero current for logic 1.

If the user chooses the 20mA option, then a backplane type 8503 is provided. The external interface consists only of current sources, transmit switch and receive load. The RS232C control signals (RTS etc.) are not available as external signals, and no external wire straps are necessary for the serial link to function.

The COMMUNE 20mA interface is suitable for half or full duplex operation when connected as a 4 wire serial link, or for half duplex operation when wired as a 2 wire serial link. In 2 wire working using a termination panel type 8038, the receiver will see all data communicated along the link, and the user program will have to include lines specifically to discard data transmitted by COMMUNE.

1.3 RS232C (V24/V28) Option

United States standard RS232C published by the Electrical Industry Association (EIA) may be regarded as directly equivalent to the international standards V24 and V28 published by the Comité Consultatif International Téléphonique et Télégraphique (CCITT).

The RS232C interface uses positive and negative voltage levels, typically +12V and -12V for logic 0 and 1 respectively.

If the user chooses the RS232C option, then a backplane type 8504 is provided. A track on this backplane provides an enable signal to the 8333 module, which allows the various control signals to be operative. A +12V power supply is brought out as part of the external interface so that signals not available from the external equipment can be asserted locally.

Typical connections
DTR and RTS output from COMMUNE.
DSR and CTS input to COMMUNE.

2. Typical Applications

2.1 Link to computer

Many proprietary mini and micro computers have a facility for one or more serial links. The provision and integration of the software for handling serial links may be expensive if it means modifying established operating systems or software packages. COMMUNE has the advantage that it can be programmed to suit the communications facilities available. Normally, any program alterations needed to make the link work correctly can be implemented in the simple stand-alone COMMUNE program.

The simplest serial link from a computer typically treats the connected device as a serial console device like a VDU or printer. COMMUNE can easily be programmed to emulate such a device, but has powerful facilities for forming characters into messages with CRC checks if greater security is desired.

2.2 Link to peripheral device

An increasing range of peripheral devices are available with asynchronous serial link interfaces. COMMUNE is suitable for interfacing to digital magnetic tape recorders (mini-cassette, cassette, mini-cartridge, cartridge etc.) and can provide an overall data transfer rate of the order of 100 words per second. It would not be suitable for very fast transfer of large quantities of data.

2.3 Telemetry interfaces

The availability of an RS232C interface with control signals makes COMMUNE suitable for connection via modems, and allows the use of relatively low cost single channel communications media. Private or public telephone circuits or radio links may be used by suitable choice of proprietary modem and communications equipment.

3. User Program Facilities

3.1 Description of language

COMMUNE is a line orientated interpreter derived from ANSI BASIC.

To simplify the task of implementing serial links, there are language extensions for handling the user's port.

The COMMUNE firmware includes automatic buffering of data to/from the user's serial port. Individual characters are transmitted and received in parallel with the execution of the COMMUNE user program. This allows communication at rates up to 9600 bit/s even

though the manipulation of individual characters in the COMMUNE user program may take longer than one character time.

In implementing a serial communications protocol, there is normally no requirement for complex mathematics or the handling of floating point variables. COMMUNE arithmetic is therefore restricted to 16 bit integer working, giving the advantage of very fast execution.

Three message checking options are included as standard (detailed in specification). Alternatively, other message checking can be programmed by the user.

The BASIC language is easy to use and easy to understand. It is usually possible for the application expert to write the COMMUNE program, without the need to involve a software expert. Typically a few days is sufficient for a user with a rudimentary knowledge of BASIC to get a COMMUNE serial link programmed and working.

As the COMMUNE system can be easily programmed or edited on site, program debugging and system commissioning can be achieved by combined tests with the equipment to which the COMMUNE system is intended to communicate.

3.2 Limitations

3.2.1 Program size

The 3595 bytes available for the user program and dynamic variables are normally sufficient for implementing any serial link protocol. Typically there is also a

limited amount of space available for data manipulation and temporary storage.

3.2.2 Window to host controller

The 32 word data window provided by the fast I/O interface limits the rate at which data can be passed to an absolute maximum of 31 words in each direction per program scan of the host controller. If the quantity of data in an individual message exceeds 31 words, then it will have to be handled in segments, and there will typically be an overhead in an additional word in each block to indicate which it is.

If message integrity is to be preserved, then the user has to take account of the fact that the time at which the host transfers data to/from the fast I/O interface is independent of the execution of the COMMUNE program.

If the COMMUNE program is much faster than the scan of the host, then it is possible to ensure that data in the fast I/O interface cannot be changed while the host is reading it. If, however, the host can read the data at the instant it is changing, then it may be necessary to set up a handshake between host and COMMUNE, requiring at least two scans of the host program per 31 words of data transfer.

Similarly, it is possible for the host controller output data to change while it is being read by the COMMUNE user program. A simple avoidance technique is to use a flag in the highest D table location to indicate when a new set of data is present, and to read

the lower D locations immediately after the flag changes. Since the host controller scans the fast I/O highway from the lowest address upwards, the lower locations cannot change until the next scan.

3.2.3 Serial I/O buffer sizes

The presence of automatic buffering of data to/from the serial link means that it is not necessary to deal with each received character in the COMMUNE program before the next can be received.

Data will, however, be lost if more than 200 characters accumulate in the input buffer. A message shorter than 200 characters can be received at the fastest data rate, regardless of the speed of the COMMUNE user program, provided that another message cannot arrive before the first has been dealt with. If the user wishes to use messages longer than 200 characters, or messages can arrive in quick succession, then he should ensure that the COMMUNE program handles the messages fast enough.

Unless the user's program takes any other action, then, when the transmit buffer becomes full the program will simply wait at the link output instruction until space becomes available in the buffer. Before attempting to perform another link output, the user can check the number of bytes still awaiting transmission with the BUFFER function, and skip to some other section of the COMMUNE program if this link output would fill the buffer.

3.2.4 Execution speed

Although COMMUNE is much faster in execution than many commercially available BASIC systems, there is nevertheless a speed limitation inherent in the use of an interpretive system.

Typically it takes between 1 ms and 5ms to handle each character to and from the user's serial port, depending on the complexity of the protocol.

For signalling rates below 4800 bit/s, COMMUNE is typically able to deal with each character as it is transmitted or received. At 9600 and 4800 bit/s, there is a tendency for the data handling by the COMMUNE user program to be slower than the transmission rate on the serial link, and the user is advised to check that any time lag is acceptable to his system.

3.2.5 16 bit arithmetic

Calculations within COMMUNE are restricted to integers in the range -32768 to +32767.

COMMUNE can handle numbers outside this range, provided that they are presented in string format, and that COMMUNE simply passes the strings to/from the serial link. This technique allows the handling of numbers with a decimal point, or large numbers, or numbers in BCD or other coded form.

4. Termination Panels

4.1 Termination panels for 2 ports

The standard 8035 and 8038 termination panels both provide terminals for two serial ports. Port 1 is for the user's serial link. Port 2

is the programming port with parallel connections at the D type connector on the module front panel.

Normally the user will employ the front panel connector for connections to the programming unit, and will leave open circuit the corresponding terminals on the termination panel.

If a programming link is constructed to a remote point via the termination panel, then the front panel connector cannot be used for programming or monitoring unless there is an open circuit at the far end of the remote programming link.

4.2 Other termination units

The 20mA option of COMMUNE is compatible with the 2 wire serial link termination unit type 8925 and the fibre optic transceiver type 8927.

These units contain active electronics which prevent the receiver from seeing the data transmitted from the same port. They cannot be used for full duplex working.

5. Associated Documentation

The 8847 Serial Communications User Information Leaflet (T423) provides full details for programming in the COMMUNE language, for estimating program size and execution speed, and for wiring the external hardware interface.

The GEM80 Serial Links User Information Leaflet (T418) provides comprehensive technical information about standard GEM80 Serial links using ESP protocol, which will be relevant if the user wishes to implement ESP protocol.

Ordering Codes

1. Equipment

20mA current loop Programmable
Serial Communications kit:-
comprising module, backplane, 20
way ribbon cable and termination
panel 8847-4201.

RS232/V24 Programmable Serial
Communications Kit:-
comprising module, backplane, 8
way cable loom and termination
panel 8847-4202.

2. Optional extras

Mounting channel 8959-0000
A pair of mounting channels at
222mm centres provides support for
two termination panels type 8035 or
8038.

3. Spares

Programmable serial
communications module 8333-4001
Battery 20T-0318/01.



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