MICROSTART Generator Controller

RS232 COMMUNICATIONS ('C') OPTION

This version of Microstart is fitted with an RS232C interface, enabling it to communicate with a remote 'control centre' via a suitable pair of modems and the public switched telephone network (PSTN).

With such a set-up, a remote operator - either end-user, generator manufacturer or service engineer - may interrogate Microstart about the current status of the generator and control the starting, stopping and load transfer of the set. Such Microstarts can also be programmed to automatically dial up a remote control centre and leave an appropriate message whenever a generator fault is registered.
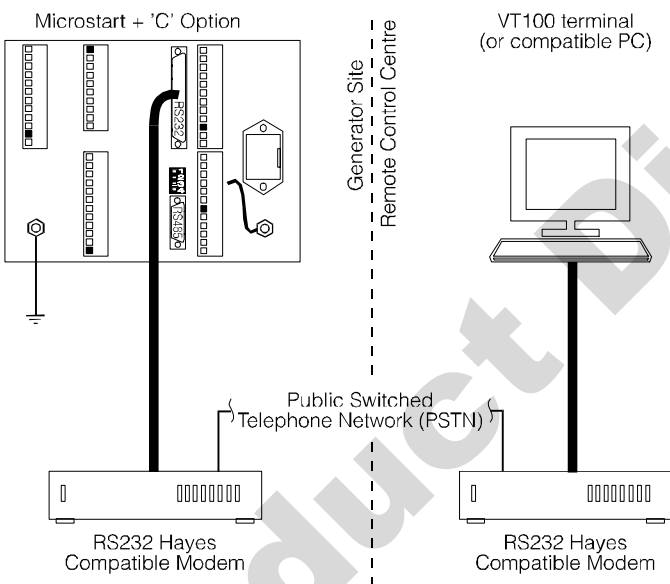
FAMILIARISATION

Microstarts with a communications facility are identified by a 'C' in the part number, e.g. MS1A<u>C</u>. (The part number may be found on the yellow connection label on the top side of each unit.)

The units are characterised by two 'D' type terminals at the rear: the upper, 25 way connector is the RS232C interface. *(N.B. The lower, 9 way connector is intended as an output for a future RS485 interface. As of March 1995, the protocol and software for this has yet to be finalised, and no attempt should therefore be made to connect to this port, nor to tamper with the bank of 4 DIL switches located close by).*

Apart from the connection of the RS232 port, the installation and connection of a 'C' option Microstart is the same as any standard unit. Communications type units *do* however require an extra two 'program mode' function groups to be set up (see 'programming' below).

CONNECTING UP

The overall connection schematic for the communications circuit is as follows:

Both modems must be of a Hayes compatible type. The Microstart modem should ideally incorporate either a battery backed-up or DC power supply, allowing communication to take place during a mains or generator failure.

The remote 'terminal' should comprise a minimum of a DEC VT100 compatible terminal - usually with a printer echo - or a device capable of emulating VT100, e.g. an IBM compatible PC with suitable software.

Connection at the generator site...

Before any connection is made, ensure that both Microstart and its modem are powered down. Using a fully screened, Hayes compatible connection lead (e.g. RS202-739), make a direct connection between the 25 way (male) connector at the rear of Microstart and the 25 way (female) connector on the modem. Each connector should be located, then secured in position using the two fixing screws.

Connect the modem's PSTN and power supply connections in accordance with the manufacturer's instructions, then power up the units in the following order: modem first, Microstart second.

At the control centre...

With modem and terminal powered down, make a similar, direct connection between the modem's 25 way female connector and the serial communications port on the terminal/PC.

A screened, Hayes compatible lead should again be used, but the type of lead will depend on the type of 'D' connector on the terminal/PC. This is normally either a 25 way or 9 way connector: for 25 way types, use a similar lead to that employed at the generator modem; for 9 way types, a slightly different lead should be used (e.g. RS 202-745). Each end of the lead should again be connected, then secured using the two screw fixings.

Make the power supply and PSTN connections to the modem, then power up the units - modem first, terminal second.

PROGRAMMING

The standard version of Microstart has five groups of programmable functions:

> 'event inputs'
> 'charge fail'
> 'timers'
> 'system values'
> 'switches'.

The 'C' option Microstart has the same five groups (which are programmed as normal), plus 2 extra groups: 'Set Date & Time?' and 'Set communications?'. The option to enter and re-program these groups is given after programming the 'set switches' group:

<u>Setting Date and Time</u>:

```
┌──────────────────────┐
│ Set Date & Time ?     │
│    No: ↓  Yes: ↵       │
└──────────────────────┘
```
Press ↵ to re-program date and time.

```
┌──────────────────────┐
│ Mon 16th Jan 1995     │
│ Change: ←↑↓→ Done: ↵   │
└──────────────────────┘
```
Use ← or → to select in turn the date, month and year fields (as indicated by the underlining cursor) and ↑ or ↓ to alter each one. (Note that the 'day' field changes automatically as the others are set). When the correct date is displayed, press ↵ to enter.

```
┌──────────────────────┐
│ Time:  14:57:33       │
│ Change: ←↑↓→ Done: ↵   │
└──────────────────────┘
```
Use ← or → to select in turn the hours, minutes or seconds segments (as indicated by the underlining cursor) and ↑ or ↓ to set the value of each. (Note that 'hours' segment is in 24 hour format.) When the correct time is displayed, press ↵ to enter.

<u>Setting Communications Functions</u>:

```
┌──────────────────────┐
│ Set communications?   │
│    No: ↓  Yes: ↵       │
└──────────────────────┘
```
Press ↵ to set up communications.

```
┌──────────────────────┐
│ "Installation Name"   │
│ Change: ←↑↓→ Done: ↵   │
└──────────────────────┘
```
This screen requires the entry of an 'installation name' (of up to 20 characters). When communication is initiated, this name is displayed on the remote terminal: the name/number must therefore be unique to that generator.

Use ← or → to select each character in turn (indicated by the underlining cursor) and ↑ or ↓ to change each one. When the

```
┌─────────────────────────────┐
│ Log-on Password:            │
│ MODEX        ←↑↓→  ↵        │
└─────────────────────────────┘
```

```
┌─────────────────────────────┐
│ Phone out condition         │
│   Alarm or alert    ↑↓ ↵   │
└─────────────────────────────┘
```

```
┌─────────────────────────────┐
│ Enter phone no.             │
│ 01705 637193   ←↑↓→   ↵    │
└─────────────────────────────┘
```

correct name is displayed, press ↵ to enter it into memory.

Once a communications link has been established, the remote operator is asked to enter this 5 character password (to inhibit access by unauthorised personnel). The password may be unique to that generator, or a common word used to access all such Microstarts. The default password is 'MODEX', but this may be changed by using the cursor keys as for 'installation name' above.

This specifies the circumstances under which Microstart will auto-matically dial up the remote control centre. The three options are:-

- During both 'Alarm or Alert' faults

- During 'Alarm (faults) Only'

- 'None' (i.e. never)

Use ↑ or ↓ to select the required option, then press ↵.

This specifies the phone number of the remote control centre to be dialled. Use ← or → to select each digit in turn, and ↑ or ↓ to select the number for each - this will normally be 0 to 9, but a space may also be used in the displayed number without adverse effect; if a 3 second pause is required between the dialling of digits, use the ',' (comma) symbol. When the correct number is displayed, press ↵ to enter.

Once these and all the other programmable functions have been correctly set, the procedure for exiting program mode and saving changes is as for any standard unit.

OPERATION

General

While no communication is taking place between Microstart and the remote control centre, Microstart operates as normal.

A communication link can only be initiated if Microstart's key is switched to AUTO. Once a link is made, any operator local to Microstart should notice that both amber and green LEDs around Microstart's keyswitch flash simultaneously, indicating that the Microstart is under the control of a remote operator. The local operator can, however, re-establish control of the generator at any time by turning Microstart's key to ✋ (i.e. manual mode - the operator should then note that only the amber LED is continuously lit). Turning to manual mode results in the termination of all remote communication. Communication is similarly inhibited while the key is set to O (off/reset).

If communications have been established, and a correct password entered, the remote operator is able to control and interrogate Microstart by the use of 8 commands. The way in which these commands are sent from remote operator to Microstart depends on the type and sophistication of the remote terminal and its software. This may range from a 'dumb' VT100 terminal with printer echo at the most basic level, up to an integrated plant management system with software which has been custom designed to interrogate and manage information from several different plant sources (including Microstart). Before commands can be sent, reference will therefore need to be made to each terminal/software manufacturer's literature.

For the purposes of simplicity, the examples of command messages in this document are based on a simple VT100 system, showing the commands at their basic level of ASCII text strings.

Initiating communications from Control Centre to Microstart

To initiate a link with Microstart, the remote terminal needs to send a Hayes compatible 'dial' command to its Modem. For a VT100 terminal, this typically means the operator typing in a command after the prompt (>) symbol, e.g...

>ATDP01705637193

(In this example, 'AT' signifies a Hayes command, 'D' signifies that the command is 'dial', 'P' signifies 'pulse-dialling'; '01705637193' is the number of the remote generator's modem. Reference will need to be made to the terminal literature for a full list of commands.)

...followed by pressing the 'enter' (↵) key.

The terminal Modem then dials Microstart's modem. While the link is being established, the terminal's screen will typically display the following sequence of messages:

```
ATDP01705637193 ───── Hayes 'dial' command and
                      Microstart's phone number

CARRIER 300 ───────── Carrier wave established

CONNECT 1200 ──────── Communication established
                      between modems, Baud rate 1200

Microstart Ver 0.7
----- On-line ------ ── Microstart in communication and
Enter Password:-       ready to accept commands on entry
>                      of correct password
```

In order to establish remote control over Microstart, the operator must type in the correct 5 character password, matching the password already entered into that particular unit when its 'communications' function group was programmed.

If the incorrect password is entered , Microstart does not permit further access. (Note that an indefinite number of re-attempts may be made to enter the correct password?). When the correct password is sent, Microstart responds with the following 'plant status' message:

```
MODEX UK ──────────── Site name
Mon 6th Feb 1995
Time: 18:59:10 ─────── Current date and time
---------------------
AUTO: Mains healthy── Microstart's current operating
                      mode and status
---------------------
Mains: Freq 50.0 Hz┐  Mains frequency
r230V y230V b230V  ┘  and 3 phase voltage
Gen:   Freq ---- Hz┐  Generator frequency
r 00V y 00V b 00V  ┘  and 3 phase voltage
Battery 12.6V         Other system information:
Events: 10000000      a) battery voltage
Hours run 00006       b) event input status:
Mains contactor: IN      inputs 1 to 8, left to right,
Gen contactor  : OUT     '1' = input active
>                        '0' = input inactive
                      c) hours run
                      d) mains and generator
                         contactor status
```

This message (or 'current status block') shows the current status of the Microstart and generator. Once this message has been displayed, the operator is able to control and interrogate Microstart by the use of 8 commands:

Command	Description	
>MSCSB	Current Status Block	
>MSAAM	Adopt Auto Mode	
>MSAMM	Adopt Manual Mode	
>MSRTE	Run The Engine	(manual mode only)
>MSLOG	Load On Generator	(" " ")
>MSLOM	Load On Mains	(" " ")
>MSHTE	Halt The Engine	(" " ")
>MSARM	Adopt Reset Mode	(" " ")

On a typical VT100 set-up, the operator sends the above commands by typing the appropriate 5 characters on the terminal keyboard, followed by 'enter' (↵). If an incorrect code is entered, Microstart takes

no action other than to respond with an 'error' or 'can't do this !' message.

Microstart MSCSB - Current Status Block

When this command is entered during normal operation, Microstart responds to the remote terminal with updated information about the generator and plant. The displayed message has exactly the same format as that shown after the correct entry of the password (as detailed in the above section).

If, however, the MSCSB command is sent after a generator shutdown fault, Microstart responds with information about the plant status at the instant before the shutdown occurred (NOT the current status). This 'historical' information continues to be supplied whenever the MSCSB is sent, until such time as Microstart is reset.

MSAMM - Adopt Manual Mode
MSAAM - Adopt Auto Mode

Immediately after the entry of the correct password, Microstart is in Auto mode, waiting for the remote operator's commands. A local operator (standing in front of Microstart) would be able to see that:

- the keyswitch is set to Auto

- both green (auto) and amber (manual) keyswitch LEDs are simultaneously flashing (indicating that the Microstart is being controlled remotely).

- the LCD (liquid crystal display) reads AUTO in its top left hand corner

The MSAMM and MSAAM commands effectively allow the remote operator to change Microstart's operating mode, despite the fact that the unit's key is set to Auto. When a remote MSAMM command is sent, Microstart's amber and green LEDs continue to flash, but the LCD now displays MAN in the top left hand corner. Microstart confirms that manual mode has been selected by sending an 'O.K.' message to the remote operator, who is then free to start the engine, transfer load between mains and generator and stop the engine (see separate commands below).

The remote operator can revert to Auto operation at any time by typing the MSAAM command. (Note that Microstart's LCD reverts to displaying AUTO in its top left hand corner, and that it should again respond to the remote terminal with an 'O.K.' message). If the engine is running when this command is typed, Microstart continues to run the generator, but then returns it to 'standby' mode after any appropriate restoration or cooldown delays.

MSRTE - Run The Engine
MSLOG - Load On Generator
MSLOM - Load On Mains
MSHTE - Halt The Engine

Once manual mode has been remotely selected, the terminal operator can use the above 4 commands to start and stop the engine, and transfer the load between mains and generator.

After each command, Microstart responds to the remote terminal with a sequence of confirming or status messages, e.g. after MSRTE:-

     Preheating
     Cranking
     Engine running

After MSLOG:-

     Mains contactor: OUT
     CONTACTOR delay
     Gen contactor: IN

After MSLOM:-

     Gen contactor: OUT
     CONTACTOR delay
     Mains contactor: IN

After MSHTE:-

     Engine halted

MSARM - Adopt Reset Mode

While a communications link is in progress, any plant faults registered by Microstart are automatically signalled to the remote terminal. A typical format of message is:

MON 6th Feb 1995
Time: 18:59:10
ENGINE HALTED
LOW OIL PRESSURE

The MSARM command can be used by the remote operator to reset such a fault condition, <u>BUT SHOULD BE USED WITH EXTREME CAUTION</u>: although this command is the remote equivalent of turning Microstart's keyswitch to O (off/reset), it should be noted that an unexpected break in the communications link will automatically return Microstart to Auto mode 'proper'. In such an instance, the generator would then be free to start as and when Microstart's normal operation dictates (e.g. if a mains fail or 'remote start' occurs, or at the remote or local operator's manual command), regardless of whether the original shutdown fault is still present. Such an automatic start, with the original fault still present, could result in damage to the plant (e.g. if the problem was related to engine oil pressure or temperature).

Communications initiated from Microstart (to the Control Centre)

As detailed above in 'programming', Microstart may be set up to one of three 'phone out conditions'. If this function has been set to 'alarm and alert' or 'alarm only', Microstart will automatically dial the pre-programmed number of a remote control centre whenever such faults occur. If the remote number is engaged, Microstart rings off, then re-dials 30 seconds later. It does this indefinitely, until contact is established.

Once the remote control centre responds, Microstart downloads the following format of message:

```
MODEX UK                        ————— Site name
Mon 6th Feb 1995
Time: 18:59:10                  ————— Date & time of fault
--------------------
Engine Halted
LOW OIL PRESSURE               ————— Fault message

Enter password:-
>
```

If the remote terminal is manned, the operator can access Microstart by typing in the correct password. (Unless this is entered within 2 minutes, Microstart rings off.) Once the correct password is entered, Microstart responds with the 'status block' message (Note: if the fault is an 'alarm' type, the status block reflects the plant state at the moment before the generator was shut down). The terminal operator then has remote control over Microstart and is free to use the 8 commands as detailed above.

In most cases, however, the terminal is unlikely to be permanently manned. Assuming that the terminal has a printer echo, or some other facility for recording the incoming data, such 'events' can be periodically reviewed and action taken as necessary, e.g. dialling up the appropriate Microstart at a later time, or sending a service engineer to site. Remote terminals with more advanced software may additionally provide a 'flagging' function to alert the operator of any incoming message (e.g. by use of an audible warning).

Ending Communications

The remote operator can end communications at any time, usually by use of the terminal/computer's 'hang up' command (please refer to the manufacturer's data).

Once the two modem's have hung up, Microstart returns to Auto mode 'proper' (assuming that its key is still in this position), and the keyswitch LEDs revert from flashing amber and green to continuous green. The remote terminal then becomes free to dial or receive communication from other Microstarts.

Electrical interference and very short breaks in the communications link are invariably handled by the error correction mechanisms within each modem. A longer or permanent break invariably results in an automatic hang-up by the modems, which again causes Microstart to revert to Auto mode 'proper'.

As previously mentioned, communications are also broken (Microstart tells its modem to hang up) if the local operator assumes manual control of the generator by turning Microstart's key to ✋. In this event, the remote terminal's modem will normally signal a 'NO CARRIER' message before automatically hanging up itself.

Configure events? ─ [↵]

Set charge fail? ─ [↵]

Configure timers ? ─ [↵]

Set system values? ─ [↵]

Set switches ? ─ [↵]

Please refer to our separate 'Programming Microstart' sheet (ref. msrrprog) for full details of these standard functions

Set Date & Time? ─ [↵]

Set date
e.g. Mon 16th Jan 1995 ───
(use [↑] [↓] [→] [↚] to ammend)
[↵]

Set time
e.g. 14:57:33
(use [↑] [↓] [→] [↚] to ammend)
[↵]

Set communications? ─ [↵]

Installation Name
e.g. MODEX UK1
(use [↑] [↓] [→] [↚] to ammend)
[↵]

Log-on Password
e.g. MODEX
(use [↑] [↓] [→] [↚] to ammend)
[↵]

Phone out Condition
[→] ┌ Alarm or Alert ┐
[↚] └ Alarm Only   ┤ ─ [↵]
     None

Enter Phone Number
e.g. 01705637193
(use [↑] [↓] [→] [↚] to ammend)
[↵]

exit program mode? ─ [↵]

switch Microstart to ◯ to save program changes

[↑]