For further information please refer to:-

2604 Engineering Handbook, Part No. HA026761

2604 Installation and Operation Handbook Part No. HA026491

2000 Series Communications Handbook, Part No. HA026230

These may be found on //http/www.eurotherm.co.uk/pdfs
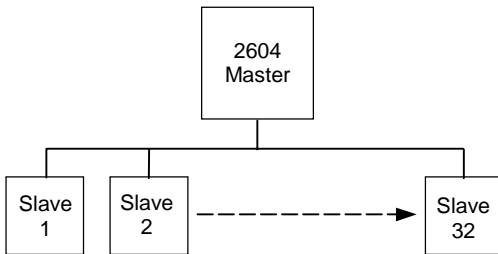
B. Supplement   2604 Master Communications

B.1. INTRODUCTION

Software version 5 and above of the 2604 controller supports Master Communications. The objective of the master comms is to allow the 2604 to communicate with any instrument using ModBus interface as a master device, that is, without the need for a supervisory PC. This allows the 2604 to link through digital communications with other products to create a small system solution. There are two methods of communication:-

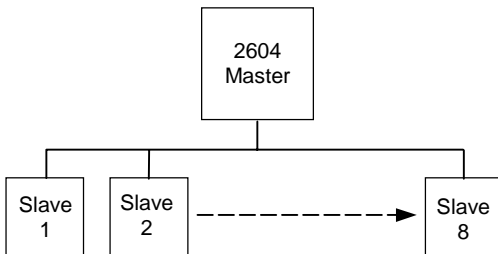1.   Broadcast Communications

2.   Direct Read/Write

B.1.1. Broadcast Communications

The 2604 master can be connected to up to 32 slaves. The master sends a unit address of 0 followed by the address of the parameter which is to be sent. A typical example might be a multi zone oven where the setpoint of each zone is required to follow, with digital accuracy, the setpoint of a master.

```
                         ┌──────────┐
                         │   2604   │
                         │  Master  │
                         └────┬─────┘
            ┌─────────────────┼─────────────────┐
       ┌────┴────┐       ┌────┴────┐        ┌────┴────┐
       │  Slave  │       │  Slave  │ - - - >│  Slave  │
       │    1    │       │    2    │        │   32    │
       └─────────┘       └─────────┘        └─────────┘
```

B.1.2. Direct read/write

The 2604 master can be connected to up to eight slaves. Each slave has its own unit address. The master can send data to each slave by sending a unit address followed by the parameter address. It can also request data from a slave. This data may be displayed on the 2604 or used as part of a 2604 control strategy.

```
                         ┌──────────┐
                         │   2604   │
                         │  Master  │
                         └────┬─────┘
            ┌─────────────────┼─────────────────┐
       ┌────┴────┐       ┌────┴────┐        ┌────┴────┐
       │  Slave  │       │  Slave  │ - - - >│  Slave  │
       │    1    │       │    2    │        │    8    │
       └─────────┘       └─────────┘        └─────────┘
```

B.2. INSTALLATION

The 2604 Master Communications controller should be installed as described in Chapter 2 of the Installation and Operation Handbook.

WARNING

⚠ **You must ensure that the controller is correctly configured for your application. Incorrect configuration could result in damage to the process being controlled, and/or personal injury. It is your responsibility, as the installer, to ensure that the configuration is correct.**   See 2604 Engineering Handbooks for details.
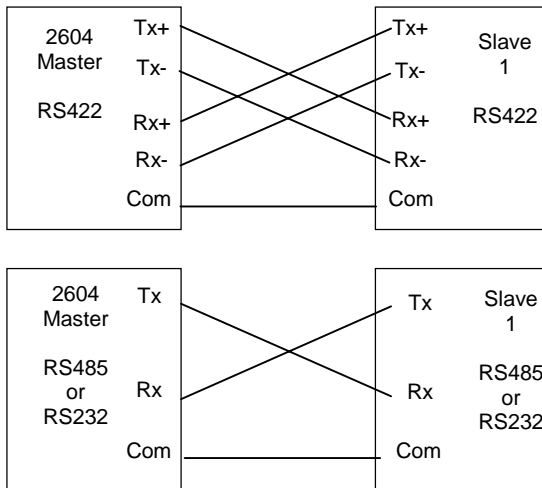
B.3. WIRING CONNECTIONS

Before proceeding further, please read Appendix B, Safety and EMC information, in the above handbooks.

The Digital Communications module for the master/slave controller is fitted in Comms Module slot J and uses terminals JA to JF. The connections are identical to the RS485 2-wire standard or RS422 4-wire standard as described in further detail in the 2000 series Communications Handbook.

ℹ **Note: Rx connections in the master are wired to Tx connections of the slave**

Tx connections in the master are wired to Rx connections of the slave

Figure B-1:   Master/Slave Connections

B.3.1. Example Wiring RS422 for Different Slaves

The diagram below shows connections for a range of different controllers using RS422. These are representative of typical slaves which may be used but could also include third party products using Modbus protocol.
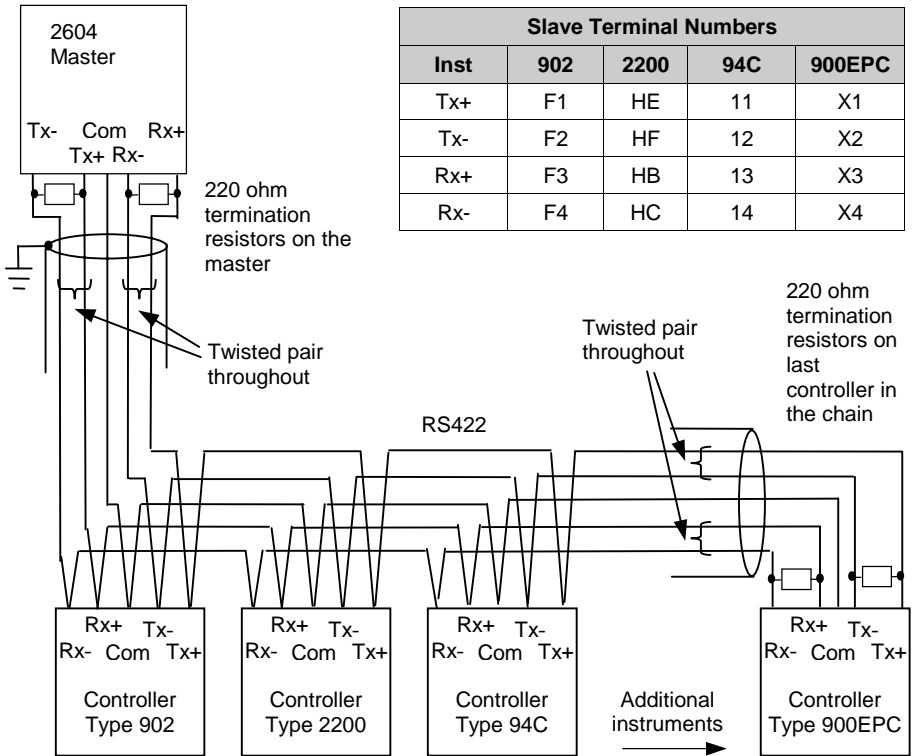
Slave Terminal Numbers				
Inst	**902**	**2200**	**94C**	**900EPC**
Tx+	F1	HE	11	X1
Tx-	F2	HF	12	X2
Rx+	F3	HB	13	X3
Rx-	F4	HC	14	X4

Figure B-2:   Example Wiring RS422 for Different Slaves

B.4. SWITCH ON

A short self test sequence takes place during which the controller identification is displayed together with the version number of the software fitted. For master communications the version number must be greater than 5.0.
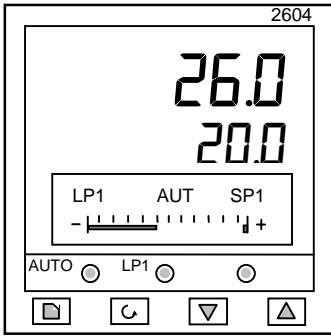
An overview display will then be shown. The format of this display will depend upon the process application for which the controller has been configured. Some typical overviews are shown in both the Operation and Engineering Handbooks.

Figure B-3:   An Example of Overview Display

Note: If master comms is fitted as an upgrade, check also the crossboard version before configuring master comms. This parameter can be found in configuration level in 'INSTRUMENT (Info Page) 'CBC Version' and must be greater than 4.7 (displayed as 47).

To configure the controller for master communications it will be necessary to navigate to configuration access level (see Engineering Handbook). A summary of navigation is shown below.

B.4.1. Basic Navigation

Parameters are organised into pages. Each page is given a name or header which describes a particular subject – in this case 'MASTER COMMS'

- press [□].to access the page

- press [▲] or [▼] to select the header

The MASTER COMMS page is divided into sub-headings, for example 'Parameters', 'Slave 1', etc

- press [↻].to access

- press [▲] or [▼] to select the header

Parameters for the chosen subject are found in these pages

- press [↻]. again

To change the value of alterable parameters

- press [▲] or [▼]
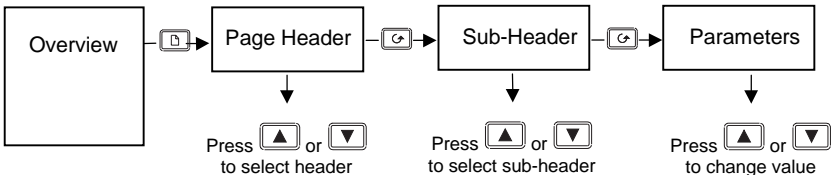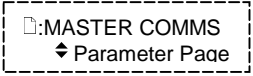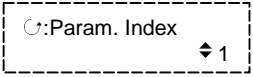
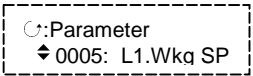**Figure B-4:   Summary of Basic Navigation**

Examples are shown in the following two sections.

B.5.   TO CONFIGURE PARAMETERS

Set controller access level to **'Config'** as described in the Engineering Handbook.

The parameters required to configure a transaction between a local parameter in the master and a parameter in the slave are shown in Table 1. To configure these parameters:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press ⬚ as many times as necessary to access the **'MASTER COMMS'** page header	⬚:MASTER COMMS ✦ Parameter Page	These parameters configure a transaction between a local parameter in the 2604 and a parameter in a slave.
2. Press ⬚ to display the first parameter in the 'Parameter Page' 3. Press ▲ or ▼ to index the parameter 1 to 25	↻:Param. Index ✦ 1	This selects which parameter (1 to 25) to read or write to. The ✦ indicates the value can be changed
4. Now press ⬚ to select the **'Parameter'** in the master 5. Press ▲ or ▼ to set the Modbus address of the parameter	↻:Parameter ✦ 0005: L1.Wkg SP	Commonly used parameters (see App. D - Engineering Handbook) are followed by a short description. To edit the parameter using this description press ⬚ followed by ▲ or ▼

6. Now press ⟳ to select the address of the slave in which to send (or receive) the parameter. 7. Press ▲ or ▼ to change the value	⟳:Slave Address ⬍ 1	In this example the slave address is 1. For broadcast comms set this value to 0
8. Now press ⟳ to select **'Slave Param**eter' address 9. Press ▲ or ▼ to change the value	⟳:Slave Param ⬍ 2	Range 0 to 65535. This full range is only necessary for IEEE. It is necessary to give the full IEEE address to get true floating point. For example in Eurotherm controllers PV = 8000 Hex or 32767. (See also section B.8.1.)
10. Now press ⟳ to select **'Scaling'** for the parameter 11. Press ▲ or ▼ to change the value	⟳:Scaling ⬍ XXXX.X	See table 1 for choices
12. Now press ⟳ to select **'Function'** 13. Press ▲ or ▼ to change the value	⟳:Function ⬍ Write	This sets the function to be read or write. See table 1 for full list of choices
14. Now press ⟳ to select **'Repeat Rate'** 15. Press ▲ or ▼ to change the value	⟳:Repeat Rate ⬍ 0:00:00.0	This sets the time between transmissions. 0 = continuous

B.6. TO CONFIGURE SLAVES

The controller must be in 'config' mode.

The parameters required to configure the characteristics of the slaves are shown in Table 2.
To configure the slave parameters:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press ⬜ as many times as necessary to access the **'MASTER COMMS'** page header	⬜:MASTER COMMS ⬍ Parameter Page	
2. Press ⬆ or ⬇ to select the Slave to be configured	⬜:MASTER COMMS ⬍ Slave 1 Page	Up to eight slaves can be configured
3. Press ↵ to select the first parameter in this page 4. Press ⬆ or ⬇ to change the value	↻:Address ⬍ 1	The slave address is in the range 0 to 254 and does not necessarily have to be the same as the slave number. 0 is reserved for broadcast comms.
Repeat 3 and 4 to set up further parameters.		See table 2 for a description of the parameters and settings

B.7. PARAMETER TABLES

Table Number: 1	These parameters configure a transaction between a local parameter in the 2604 and a parameter in a slave.		MASTER COMMS (Parameter Page)		
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**	
Param. Index	Select up to 25 parameters to read or write to.	1 to 25			
Parameter	The address of the parameter in the 2604 which is to be sent to a slave. OR the address in the 2604 in which a parameter sent from a slave is stored.	modbus address shown as 'address' followed by 'name of commonly used parameter'			
Slave Address	The address of the slave where the parameter is to be sent or received. 0 is broadcast mode in which the parameter is sent to all slaves	0 to 254			
Slave Param.	The parameter address in the slave	0 to 65535			
Scaling	Scaling of the parameter in the slave				
	No. of decimal points	XXXXX			
	Time transmitted as seconds	sss			
	Time transmitted as minutes	mmm			
	Time transmitted as hours	hhh			
	Time transmitted as tenths of seconds	ss.s			
	Time transmitted as tenths of minutes	mm.m			
	Time transmitted as tenths of hours	hh.h			
	IEEE Float 32 bit (see section B.8.1)	Euro REAL			
	Time transmitted as 32 bit msec	Euro TIME			

Function	Disables the transaction	None		
See Note 1 below	Set to Read(3) for parameters with modbus function code 3	Read(3)		
	Set to Read(4) for parameters with modbus function code 4	Read(4)		
	Set to Write to write at a repeat rate	Write		
	Set to Change Write to write only if the parameter value has changed	Change Write		
Repeat Rate	Time between transmissions. 0 is continuous	0 to 99:59:59.9		
Status	Set to good on leaving config	Good		
	Slave returned illegal address	Addr Error		
	Slave returned illegal value	Data Error		
	Slave returned Modbus exception	Error		
	Error in message returned by slave	Failed		
	Value read was out of limits or the parameter is unalterable	Store Error		
	Parameter is OEM secured and will not be transmitted	Secured		
	No response from slave	Timed Out		
	The master has no parameter associated with the specified modbus address. Config only	No Parameter		
	Parameter value unchanged since last transmit. Relevant to change write only.	Unchanged		
	The slave does not support block write	No Block Write		

Note 1:-

Function codes are a single byte instruction to the slave describing the action to perform.

Function code 3 – Read Output Registers - allows the binary contents of holding registers to be obtained from the addressed slave.

Function code 4 – Read Input Registers – obtains the contents from input registers of the addressed slave.

For the 2000 range of controllers either function code can be used. For other slaves refer to the manufacturers documentation.

Table Number: 2	These parameters configure the characteristics of the slaves		MASTER COMMS (Slave1 to 8 Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Address	The modbus address of the slave	0 to 254		
Resolution	To set resolution configured in the slave to Full or Integer	Full Integer	Full	
Timeout(msecs)	Time to wait for a response from a slave	20 to 2000	100mS	
Retries	Number of times to retry before the status goes to 'Timed Out'	1 to 100	1	
Status	Offline and Online are user selectable. If the transaction is not completed in the time set by the 'Timeout' parameter in the specified number of 'Retries' the message 'Timeout' will be displayed. The message 'Recovering' appears fleetingly	Offline Online Timed Out Recovering		
Block Write	Set to the maximum block size supported by the slave. For IEEE this must be set to >0 (see also section B.8.1)	0 to 100	0	

B.8. ADDITIONAL NOTES

B.8.1. IEEE in 2000 Series

This section applies specifically to 2000 series instruments. If the slave is not a series 2000 instrument a knowledge of the communications format for the slave is required.

One of the main limitations of Modbus is that only 16 bit integer representations of data can normally be transferred. In most cases, this does not cause a problem, since appropriate scaling can be applied to the values without losing precision. If the slave is a series 2000 instrument, where all values are shown on a 4 digit display, values may be transferred in this way. However this has the significant drawback that the scaling factor to be applied needs to be known at both ends of the communications link.

One further problem is that certain 'time' parameters, notably those used for the programmer function can be returned over the communications link in tenths of seconds, minutes or hours. It is possible. therefore, for long durations to overflow the 16 bit Modbus limit.

To overcome these problems, a sub protocol has been defined, using the upper portion of the Modbus address space (8000h and upwards), allowing full 32 bit resolution floating point and timer parameters. This upper area is known as the IEEE region.

This sub-protocol provides two consecutive Modbus addresses for all parameters. The base address for any given parameter in the IEEE region can easily be calculated by taking its normal Modbus address, doubling it, and adding 8000h. For example, the address in the IEEE region of the Target Setpoint (Modbus address 2) is simply

$$2 \times 2 + 8000h = 8004h = 32772 \text{ decimal}$$

This calculation applies to any parameter in a series 2000 slave that has a Modbus address.

Access to the IEEE area is made via block reads (Functions 3 & 4) and writes (Function 16). Attempts to use the 'Write a Word' (Function 6) operation will be rejected with an error response. Furthermore, block reads and writes using the IEEE region should only be performed at even addresses, although no damage to the instrument will result in attempting access at odd addresses. In general, the 'number of words' field, in the Modbus frame, should be set to 2 times what it would have been for 'normal' Modbus.

The rules governing how the data in the two consecutive Modbus addresses are organised depending on the 'data type' of the parameter.

See also 'Series 2000 Communications Handbook Chapter 7.

B.8.2. Configuration mode

The Master does not communicate in configuration mode.

During configuration, if there is no parameter in the master with the specified modbus address the Status is set to 'No Parameter' and on exit from configuration mode all parameters defining that transaction are set to their cold start values.

Parameter Name	Cold Start Value
Parameter	None
Slave Address	1
Slave Parameter	0
Repeat Rate	0:00:00.0
Function	None
Scaling	XXXXX
Status	Good