

## **Communications Manual**

Quantima

# Q26, Q34, Q43, Q52, Q70L

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Oil Free Compressors Water-Cooled

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## 1 Introduction

## 1.1 General

- 1.1.1 This manual describes the various communications options available on the Quantima compressor. There are three options described.
  - 1) Remote monitoring used by CompAir to assess the performance of the compressor.
  - 2) Local monitoring to enable the user to access compressor data, for instance when connecting to a building management system.
  - 3) Integration of the Quantima with a system controller using communications control.

## 2 Safety Procedures

### **Warning**:

Installation work must only be carried out by competent personnel under a qualified supervisor.

The compressor unit must only be operated by competent personnel under a qualified supervisor.

Do not run the compressor with doors open or covers removed.

Never remove or tamper with the safety devices, guards or insulation materials fitted to the unit.

#### 2.1 General

- 2.1.1 Most accidents which occur during the operation and maintenance of machinery are the result of failure to observe basic safety rules or precautions. An accident can often be avoided by recognising a situation that is potentially hazardous.
- 2.1.2 When handling, operating or carrying out maintenance on the unit, personnel must use safe engineering practices and observe all relevant local health and safety requirements and regulations. The attention of users in the UK is drawn to the Health and Safety at Work Act, 1974, and to the Regulations of the Institution of Electrical Engineers.
- 2.1.3 CompAir cannot anticipate every possible circumstance which might represent a potential hazard. The **WARNINGS** in this manual are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by CompAir he must ensure that the unit will not be damaged or made unsafe and that there is no risk to persons or property.
- 2.1.4 The standard build of all CompAir products are not intended for use in either explosive or potentially explosive atmospheres as defined in Directive 94/9/EC.
- 2.1.5 An explosive atmosphere is a mixture with air, under atmospheric conditions, of flammable gases, vapours, hazes, or dust in which, after ignition has occurred, combustion propagates to the entire unburned mixture and may cause a hazard.

- 2.1.6 A potentially explosive atmosphere is an atmosphere which could become explosive due to local conditions.
- 2.1.7 Failure to observe the precautions given under 'Safety Procedures' may be considered dangerous practice or misuse of the compressor unit.

## 2.2 Warnings, Cautions And Notes

2.2.1 Warnings

Warnings call attention to operations or procedures involving specific hazards which could cause injury or death and are identified by the following symbols on the unit and in the text of the manual.



WARNING: Risk Of Danger



WARNING: Risk Of Electric Shock

WARNING: Risk Of Hot Surfaces



WARNING: Consult Manual



WARNING: Risk Of High Pressure



WARNING: Never operate the unit with open doors or loose access panels.

2.2.2 Cautions

Incorrect operational procedures causing possible damage to the compressor unit are identified by a **'CAUTION'** in the text of this manual.

2.2.3 Notes

Methods to make the job easier and points which require particular attention are identified by a **'Note'** in the text of the manual.

## 2.3 General Safety Precautions

- 2.3.1 If using compressed air for cleaning purposes, ensure safety regulations are complied with and appropriate clothing and eye protection is worn.
- 2.3.2 Never direct compressed air onto your skin or at other people.
- 2.3.3 Never use compressed air to clean loose dirt from clothing.
- 2.3.4 Before releasing compressed air through a hose make sure that the free end is held securely so that it cannot whip and cause injury.
- 2.3.5 Avoid injury by using a hoist to lift heavy loads. Check that all chains, hooks, shackles and slings are in good condition and are of the correct capacity. They must be tested and approved according to local safety regulations.
- 2.3.6 Cables, chains or ropes must never be applied directly to lifting eyes. Always use an appropriate shackle or hook, properly positioned. Arrange lifting cables so that there are no sharp bends.
- 2.3.7 Use a spreader bar to avoid side loads on hooks, eyes and shackles.
- 2.3.8 When a load is on a hoist stay clear of the danger area beneath and around it. Keep lifting acceleration and speed within safe limits. Never leave a load hanging on a hoist for longer than is necessary.

## 2.4 Installation Precautions

- 2.4.1 Installation work must only be carried out by competent personnel under a qualified supervisor.
- 2.4.2 A fused isolating switch must be fitted between the main power supply and the compressor.
- 2.4.3 The air intake is to be located so that no hazardous constituent (solvent vapour, etc., but also dusts and other hazardous material) can be sucked in. This applies also to flying sparks. This could cause an internal fire or explosion.
- 2.4.4 Precautions must be taken to ensure that no injury is caused to passers-by through loose clothing being sucked into the air intake.
- 2.4.5 Ensure that the air delivery pipe from the compressor to the user's pipework or receiver

is free to expand and that no flammable material is in the vicinity.

- 2.4.6 A shut-off valve must be fitted in the delivery air line to enable the compressor unit to be isolated. This is particularly important if more than one unit is to be coupled in parallel or connected to an existing air supply system.
- 2.4.7 The non-return valve is not intended as an isolating valve and should not be relied upon for this purpose. In addition, it may be necessary to install shut-off valves elsewhere in the system to allow a dryer or other equipment to be by-passed.
- 2.4.8 A safety relief valve must be installed between any compressor unit and the shut-off valve/s.
- 2.4.9 A pressure-relieving device must be fitted to every pressure vessel or equipment containing air at above atmospheric pressure, when installed downstream of the unit.
- 2.4.10 If raised platforms are required to provide access to the unit they must not interfere with normal operation or obstruct access for lifting or dismantling components. Platforms and stairs should be of grid or plate construction with safety rails on all open sides.
- 2.4.11 This machine is not intended for outdoor use.
- 2.4.12 When designing the compressor room ventilation, be aware that, when running, the compressor will cause the temperature in the compressor room to rise.

## 2.5 Operational Precautions

- 2.5.1 The compressor unit must only be operated by competent personnel under a qualified supervisor.
- 2.5.2 Do not run the compressor with doors open or covers removed.
- 2.5.3 Never remove or tamper with the safety devices, guards or insulation materials fitted to the unit.
- 2.5.4 The compressor must only be operated at the supply voltage and/or frequency for which it is designed.
- 2.5.5 When mains power is switched on, lethal voltages are present in the electrical circuits and extreme caution must be exercised whenever it is necessary to carry out any work on the electrical system.
- 2.5.6 When the unit is running under automatic control, attach a sign stating **'THIS UNIT MAY**

START WITHOUT WARNING' next to the display panel.

- 2.5.7 If the unit is equipped with a Remote Start device, attach warning notices stating **'THIS UNIT CAN BE STARTED REMOTELY'** in prominent locations, one on the outside of the unit, the other inside the control compartment.
- 2.5.8 As a further safeguard, take adequate precautions to make sure there is no one checking or working on the unit before attempting to operate remote start equipment. Attach a notice stating 'CHECK THAT ALL PERSONNEL ARE CLEAR OF THE unit BEFORE STARTING' or similar wording to the remote start equipment.
- 2.5.9 Some parts of the compressor and the ventilation air exhausted from the compressor can reach very high temperatures. Take precautions against burns when touching any parts inside the compressor or externally in the vicinity of the ventilation openings. Allow hot parts to cool down to room temperature or wear heat insulating gloves.
- 2.5.10 If there is any indication that the compressor is overheating it must be shut down and the cause investigated. Beware of burns from hot metal parts.
- 2.5.11 The 'Noise at Work Regulations 1989' suggest that ear protectors should be worn where noise levels are 85 dB(A) or higher. With all covers in place, the noise levels of the compressors described in the manual are substantially lower than this figure unless there are local environmental influences.
- 2.5.12 Be aware that high noise levels can interfere with communication.
- 2.5.13 Only use hose couplings and fittings of the right type and the correct size.

## 2.6 Maintenance and Repair Precautions

- 2.6.1 Maintenance, repairs or modifications must only be carried out by CompAir, or CompAir-authorised personnel.
- 2.6.2 Make sure that all instructions concerning the operation and maintenance are strictly followed and that the complete unit, with all accessories and safety devices, is kept in good running order.
- 2.6.3 Protect the motor, air intake, electrical and regulation components against the entry of moisture, e.g., when steam cleaning.

- 2.6.4 Never use a light source with an open flame to inspect any part of the unit.
- 2.6.5 Check the direction of rotation of the fan motors and main drive motor when starting up the compressor initially and after any work on the electrical connections or switchgear (refer to the Technical Data section of this Manual).
- 2.6.6 Do not use any flammable liquid to clean valves, filter elements, air pipes or any component carrying a flow of air during normal operation. If chlorinated hydrocarbon non-flammable fluids are used for cleaning, safety precautions must be taken against any toxic vapours which may be released.
- 2.6.7 Do not use carbon tetrachloride.
- 2.6.8 Precautions must be taken when using acids, alkalis and chemical detergents for cleaning machine parts and components. These materials cause irritation and are corrosive to the skin, eyes, nose and throat. Avoid splashes and wear suitable protective clothing and goggles. Do not breathe mists. Ensure that soap and water are readily available.

## \land Warning

The use of replacement parts not supplied or approved or installed by CompAir may lead to failures in service which would not be covered by warranty.

Any unauthorised modifications or failure to maintain this equipment in accordance with the maintenance contract may make it unsafe. The use of replacement parts not supplied, approved or fitted by CompAir may create hazardous conditions over which CompAir has no control.

Such hazardous conditions may lead to accidents that can be life threatening, cause substantial bodily injury or result in damage to the equipment. CompAir can bear no responsibility for equipment in which unapproved repairs and replacement parts are included.

#### 2.7 Unlimited Automatic Restart After Power Failure

2.7.1 The control system is able to conduct an automatic restart after a power failure of any length. For this purpose, you must have read the following safety information and, by entering a code, enable unlimited automatic restart. Please request the required code from Quantima Technical Support.

Marning: In this operating mode, the compressor can start automatically at any time and after power failure of unlimited duration. Check the safety regulations applicable in your country (e.g. EN1012-1, EN60204) to ascertain whether you are allowed to perform an unlimited automatic restart and establish which safety precautions must be taken.

At all events, provide the compressor with warning signs, keep the compressor room locked and instruct personnel.

Install the main switch prescribed under EN60204 and affix appropriate warning signs there.

#### 2.8 Precautions in the event of fire

2.8.1 Use extreme caution when handling components that have been subjected to fire or very high temperatures. Some components may contain fluoroelastomer materials which decompose under these conditions to form highly corrosive residues. Skin contact can cause painful and penetrating burns resulting in permanent skin and tissue damage.

## 2.9 Disposal

- 2.9.1 When items of equipment are taken out of service for disposal it is recommended that the following instructions are adhered to:
  - In order to prohibit the 'bringing back into service' of equipment by persons unknown, it should be rendered unusable in order to avoid improper re-use.
  - Alternatively all such items of equipment should be stripped into their component form for 'material composition disposal' e.g. base metals, plastics, fabrics etc. and be subject to normal industrial waste re-cycling processes.
  - Bio-degradable items should be subject to normal industrial waste disposal processes. Ensure that no plastic, rubber or composite materials are disposed of by incineration.
  - 4) Ensure that all fluid waste e.g. anti-freeze agents, refrigerant fluids or corrosive inhibitors should be separated and disposed of by authorised salvage disposal or recycling systems ensuring that none is permitted to enter a waste water system.
  - 5) The batteries associated with the back-up power for the AMBs must be disposed of in accordance with local guidelines.

## 3 Remote Monitoring

## 3.1 General

3.1.1 The Quantima compressor is equipped with a remote monitoring system that allows the CompAir service department to assess the performance of the compressor. The monitoring system also provides prompt notification of faults that affect the compressor's operation. This remote monitoring uses an eWON VPN router to provide a secure connection to the Quantima.

## 3.2 eWON Connections

- 3.2.1 The eWON VPN router is connected internally to the Quantima control system, the Variable Frequency Drive and the Magnetic Bearing Controller. These connections enable the CompAir service to monitor most aspects of the compressor. Additionally, suitably qualified and authorised technicians can remotely make adjustments to the Quantima to improve its performance.
- 3.2.2 The eWON initiates an outgoing VPN connection to a secure server. When it is necessary to connect to a Quantima, the technician connects to the secure remote monitoring system. The system then routes through to the compressor to be monitored.

#### 3.3 Internet Connection

- 3.3.1 The eWON requires an Internet connection for its VPN connection to the CompAir secure system. This Internet connection can be provided by an external ADSL modem or router, an external 3G modem, or via the customer's network. If the Internet connection is via the customer's network, please contact the CompAir technical department as the eWON might require additional configuration. The connection method should be established prior to compressor commissioning so that it can be tested as part of the commissioning process.
- 3.3.2 The diagram below illustrates the Quantima compressor remote connection arrangements

#### 3.4 Remote Monitoring Connection Kits

Connection Kits	Part Number
ADSL	Q009-4602
3G	Q009-4603
Retrofit eWON kit	Q55022174



Fig. 3.1 - Remote Connection for Quantima

## 4 Communications Connections

#### 4.1 Methods of Connection

- 4.1.1 The Quantima compressor has two possible connection methods. They are:-
  - ModBus/RTU
  - ProfiBus DP.
- 4.1.2 Both connections can be used for monitoring and control functions. Note that only one of the connections should be used for the control function; trying to use both simultaneously will cause unpredictable performance and may damage the compressor.
- 4.1.3 The Quantima compressor is fitted as standard with an RS485 ModBus/RTU connection. This connection is provided via an RJ45 connector on the Quantima HMI panel, located next to the power connection. The RS485 connection is two wire, with default parameters of 9600 baud, 8 data bits and 1 stop bit. The default ModBus address is 1. These default values can be changed via Commissioning Page 3 of the Quantima compressor. Note that changes to the port settings only take affect after the HMI has restarted.

Commissioning Parameters 3				
IP Addressing IP Address Mask Gateway	Now 10.0.0.54 255.255.255.0 10.0.0.53	Next Powerup 10.0.0.54 255.255.255.0 10.0.0.53	Change IP	
RS485 PORT - External Communications Control Configured as Modbus RTU Slave				
Comms Timeout:		5 sec		
Net Slave Number:		1		
Port Settings	Now	Next Powerup		
Baud Rate:	9600	9600	Change settings	
Data bits:	8	8	the gettering t	
Stop bits:	1	1		
Parity:	none	none		
Parameter Change Enabled           Menu         Home         Page 1         Page 2         Page 4         Page 5				

HW 0840

Fig. 4.1 - Commissioning Page 3

4.1.4 The pin connections for the RS485 connection are shown in the following diagram and table.



Fig. 4.2 - RJ45 Pin Out

RS485 Connections		
Pin Number Connection		
1	TxRx B	
2	TxRx A	
6	Common	

4.1.5 The Quantima compressor can be fitted with an optional ProfiBus DP Connection (CompAir part number Q009-7500). This also fits into the HMI panel and uses a standard 9 way "D" - type ProfiBus connector. The ProfiBus connection will automatically adjust to match the baud rate of the ProfiBus network up to 12M baud. The Quantima compressor has a default ProfiBus address of 5. Due to the way the ProfiBus interface works, this address is fixed in the software and cannot be changed by the user. Please contact the CompAir technical department for software with different addresses. A GSD file for the Quantima ProfiBus interface is also available from the CompAir technical department.

## 5 Compressor Monitoring

## 5.1 Monitoring Parameters

5.1.1 The Quantima compressor makes available 96 parameters for monitoring its performance. These parameters can be accessed over the ModBus/RTU and ProfiBus DP connections. All of the parameters are 16 bit words and their interpretation is described later in this chapter.

## 5.2 ProfiBus Mapping

5.2.1 The Quantima ProfiBus DP interface provides 240 bytes (120 words) of data to the ProfiBus master. To access this data, suitable mappings must be added to the ProfiBus master. Once the GSD file is imported into the ProfiBus configuration tool, the Quantima interface can be added to the ProfiBus network. The interface is named "G3/MC/DSP ProfiBus Card" in the list of ProfiBus devices. To access all the parameters available from the Quantima, it is necessary to add at least two modules to the Master/Slave rack that the interface card presents. The simplest configuration to use is to add two of the "Universal module" items as shown in the image below.

Slot	Module	Order No.	l address	Q address
0	0xC0	Universal module	256-375	256-375
1	0x40	Universal module	376-495	
2				
3				
4				
5				
HW 084	5	1		1

Fig. 5.1 - ProfiBus Modules

5.2.2 The modules are then configured to map the Quantima parameter range into suitable addresses in the ProfiBus system. The first module can also be used to map the Quantima control data if the ProfiBus interface will be used for controlling the compressor. The image below shows a suggested mapping for the first module.

Module-Parameters Address/Type	2
I/O-Type: OUT-INPUT	
Output         Address:         Length [1-64]:         Unit:         Consistent over:           Start:         256         10         WORD         Total length         Total length           End:         275         0         V         V         Total length         V	
Input         Consistent over.           Start:         255         60         WORD         ▼         Total length         ▼           End:         175         100         ▼         Total length         ▼	
TManufacturer specific data. Maximum 14 bytes hexadecimal. Separated by comma! [A2.3C.5F]	
Attention! The button iCanceli will not undo a changing of an address!	
OK Cancel	

## Fig. 5.2 - First Profibus Module Settings

5.2.3 Similarly, the second module is configured to map the remainder of the Quantima parameters onto ProfiBus addresses, as shown in the following image.



Fig. 5.3 - First Profibus Module Settings

## 5.3 ModBus and ProfiBus Addresses

5.3.1 The following table gives the ModBus addresses and ProfiBus offsets for all the parameters available for monitoring. All values are 16 bit words and the notes following the table describe their interpretation.

ModBus and ProfiBus Addressing				
ModBus Address	ProfiBus Offset	Data		
400100	40	Trip Flags (see section 5.4)		
400101	42	Alarm Flags (see section 5.5)		
400102	44	Sensor Trip Flags (see section 5.6)		
400103	46	Expansion Trip Flags (see section 5.7)		
400104	48	Expansion Alarm Flags (see section 5.8)		
400105	50	Operating State (see section 5.9)		
400106	52	Stage 2 Inlet Pressure (see section 5.10.1))		
400107	54	Load Pressure (see section 5.10.1))		
400108	56	Target Pressure (see section 5.10.1))		
400109	58	Plant Delivery Pressure (see section 5.10.1))		
400110	60	Unload Pressure (see section 5.10.1))		
400111	62	System Load Pressure (see section 5.10.1))		
400112	64	System Target Pressure (see section 5.10.1))		
400113	66	System Pressure (see section 5.10.1))		
400114	68	System Unload Pressure (see section 5.10.1))		
400115	70	Comms Load Pressure (see section 5.10.1))		
400116	72	Comms Target Pressure (see section 5.10.1))		
400117	74	Comms Pressure (see section 5.10.1))		
400118	76	Comms Unload Pressure (see section 5.10.1))		
400119	78	Minimum Speed (see section 5.10.2))		
400120	80	Requested Speed (see section 5.10.2))		
400121	82	Maximum Working Speed (see section 5.10.2))		
400122	84	VFD Speed (see section 5.10.2))		
400123	86	AMB Speed (see section 5.10.2))		
400124	88	Motor Current (see section 5.10.3))		
400125	90	Air Inlet Temperature (see section 5.10.4))		
400126	92	Stage 1 Discharge Temperature (see section 5.10.4))		
400127	94	Stage 2 Inlet Temperature (see section 5.10.4))		
400128	96	Stage 2 Discharge Temperature (see section 5.10.4))		
400129	98	Plant Delivery Temperature (see section 5.10.4))		
400130	100	Water Inlet Temperature (see section 5.10.4))		
400131	102	Water Outlet Temperature (see section 5.10.4))		
400132	104	Motor Winding Temperature (see section 5.10.4))		
400133	106	Compressor Fault Status Line (see section 5.11)		

ModBus and ProfiBus Addressing			
ModBus Address	ProfiBus Offset	Data	
400134	108	Control Flags to PLC, word 1 (see section 5.12)	
400135	110	Control Flags to PLC, word 2 (see section 5.13)	
400136	112	Status Flags to HMI (see section 5.14)	
400137	114	Digital Inputs to HMI (see section 5.15)	
400138	116	Optional Analogue Inputs Selection (see section 5.16)	
400139	118	Digital Outputs to HMI (see section 5.17)	
400140	120	Compressor Inhibit Flags (see section 5.18)	
400141	122	Running Hours, high word	
400142	124	Running Hours, low word	
400143	126	On Load Hours, high word	
400144	128	On Load Hours, low word	
400145	130	Starts From Zero	
400146	132	Starts From Idle	
400147	134	Load Cycles	
400148	136	Surges	
400151	142	Air Inlet Temperature Alarm Value (see section 5.10.4))	
400152	144	Stage 1 Discharge Temperature Alarm Value (section 5.10.4))	
400153	146	Stage 1 Discharge Temperature Trip Value (section 5.10.4))	
400154	148	Stage 2 Inlet Temperature Alarm Value (section 5.10.4))	
400155	150	Stage 2 Inlet Temperature Trip Value (section 5.10.4))	
400156	152	Stage 2 Discharge Temperature Alarm Value (section 5.10.4))	
400157	154	Stage 2 Discharge Temperature Trip Value (section 5.10.4))	
400158	156	Plant Delivery Temperature Alarm Value (section 5.10.4))	
400159	158	Plant Delivery Temperature Trip Value (section 5.10.4))	
400160	160	Water Inlet Temperature Alarm Value (section 5.10.4))	
400161	162	Water Outlet Temperature Alarm Value (section 5.10.4))	
400162	164	Motor Winding Temperature Alarm Value (section 5.10.4))	
400163	166	Motor Winding Temperature Trip Value (section 5.10.4))	
400164	168	Stage 2 Inlet Pressure Alarm Value (section 5.10.1))	
400165	170	Stage 2 Inlet Pressure Trip Value (section 5.10.1))	
400166	172	Plant Delivery Pressure Alarm Value (section 5.10.1))	
400167	174	Plant Delivery Pressure Trip Value (section 5.10.1))	
400168	176	Speed Margin, rpm	
400169	178	Surge Margin, rpm	
400170	180	Run On Time, minutes	
400171	182	Auto Restart Delay, seconds	
400172	184	Cooling Time, minutes	
400173	186	Bypass Valve to Open Time, seconds	
400174	188	Aux. Contact Time, seconds	
400175	190	Speed Ramp Time, seconds	

ModBus and ProfiBus Addressing				
ModBus Address	ProfiBus Offset	Data		
400176	192	Surge Recovery Time, seconds		
400177	194	Surge Reset Time, seconds		
400178	196	Minimum Speed Recovery Time, hours		
400179	198	Offloading Time, seconds		
400180	200	Pressure PID P Term (section 5.19)		
400181	202	Pressure PID I Term (section 5.19)		
400182	204	Pressure PID D Term (section 5.19)		
400183	206	Temperature PID P Term (section 5.19)		
400184	208	Temperature PID I Term (section 5.19)		
400185	210	Temperature PID D Term (section 5.19)		
400186	212	Current PID P Term (section 5.19)		
400187	214	Current PID I Term (section 5.19)		
400188	216	Current PID D Term (section 5.19)		
400189	218	Quantima Model (section 5.20)		
400192	224	Surge Line Gradient		
400193	226	Maximum Surge Speed Offset, rpm		
400194	228	Minimum Surge Speed Offset, rpm		
400195	230	RS485 ModBus Slave Address		
400196	232	RS485 ModBus Communications Timeout, seconds		
400197	234	Operator/Service/Commissioning Level (section 5.21)		
400198	236	Operating State, first line (section 5.22)		
400199	238	Operating State, second line (section 5.23)		

## 5.4 Trip Flags

These indicate a compressor trip condition. Individual bits of the word have the following meanings:-

	Trip Flags Interpretation
Bit	Meaning
0	Emergency Stop
1	PLC Failure
2	AMB Trip
3	VFD Trip
4	Stage 1 Outlet Temperature Trip
5	Stage 2 Inlet Temperature Trip
6	Stage 2 Outlet Temperature Trip
7	Plant Delivery Temperature Trip
8	Stage 2 Inlet Pressure Trip
9	Plant Delivery Pressure Trip
10	Blower Failed
11	Fan Failed
12	Auxiliary Equipment Failed
13	Failed to reach minimum speed
14	Motor Winding Temperature Trip
15	VFD High speed Trip

#### 5.5 Alarm Flags

These indicate a compressor alarm condition. Bit meanings are as follows:-

	Alarm Flags Interpretation
Bit	Meaning
0	Impeller at end of life
1	Air Inlet Temperature Alarm
2	Stage 1 Outlet Temperature Alarm
3	Stage 2 Inlet Temperature Alarm
4	Stage 2 Outlet Temperature Alarm
5	Plant Delivery Temperature Alarm
6	Water Inlet Temperature Alarm
7	Water Outlet Temperature Alarm
8	Impeller nearly at end of life
9	Motor Winding Temperature Alarm
10	Input Power Phase Failure
11	Stage 2 Inlet Pressure Alarm
12	Plant Delivery Pressure Alarm
13	Intercooler drain failure
14	After cooler drain failure
15	Air filter blocked

## 5.6 Sensor Trip Flags

These indicate a compressor sensor failure. Bit meanings are as follows:-

CompAir

	Sensor Trip Flags Interpretation	
Bit	Meaning	
0	Stage 1 Outlet Temperature Sensor	
1	Stage 2 Inlet Temperature Sensor	
2	Stage 2 Outlet Temperature Sensor	
3	Plant Delivery Temperature Sensor	
4	Stage 2 Inlet Pressure Sensor	
5	Plant Delivery Pressure Sensor	
6	Air Inlet Temperature Sensor	
7	Water Inlet Temperature Sensor	
8	Water Outlet Temperature Sensor	
9	Surge Not Reset	
10	RS485 Data Error	
11	RS485 Communications Failure	
12	AMB Speed Sensor	
13	Input Power Phase Sensor	
14	Motor Winding Temperature Sensor	
15	HMI Communications Failure	

## 5.7 Expansion Trip Flags

These indicate a compressor expansion card trip condition. Bit meanings are as follows:-

	Expansion Trip Flags Interpretation	
Bit	Meaning	
0	Motor Current Trip	
1	System Pressure Trip	
2	Option 1 High Trip	
3	Option 2 High Trip	
4	Option 1 Low Trip	
5	Option 2 Low Trip	
6	Motor Current Sensor Failure	
7	System Pressure Sensor Failure	
8	Option 1 Sensor Failure	
9	Option 2 Sensor Failure	
10	Unused	
11	Unused	
12	Unused	
13	Unused	
14	Unused	
15	Unused	

## 5.8 Expansion Alarm Flags

These indicate a compressor expansion card alarm condition. Bit meanings are as follows:-

	Expansion Alarm Flags Interpretation
Bit	Meaning
0	Motor Current Alarm
1	System Pressure Alarm
2	Option 1 High Alarm
3	Option 2 High Alarm
4	Option 1 Low Alarm
5	Option 2 Low Alarm
6	Motor Current Sensor Alarm
7	System Pressure Sensor Alarm
8	Option 1 Sensor Alarm
9	Option 2 Sensor Alarm
10	Excess Pressure Differential Target Reduced
11	Excess Pressure Differential Unload Margin Reduced
12	VFD Heatsink Temperature Alarm
13	Unused
14	Unused
15	Unused

## 5.9 Operating State Values

The indicates the current status of the compressor as detailed in the following table:-

Operating States		
State	Meaning	
1	Initialisation	
2	Start Inhibit Not Available	
4	Ready To Start	
8	Start Inhibit Available	
16	Standby Zero Speed	
32	Standby Cooling	
64	Idle	
128	Offload Minimum Speed	
256	On Load	
512	Offload Stopping	
1024	Stopped Cooling	
2048	Surge	
4096	Surge Reset	
8192	Shutdown Cooling	
16384	Shutdown Full	

## 5.10 Notes on All Monitored Values

- 1) All pressure values are given as bar x 100, i.e. a reading of 700 represents 7.00 bar.
- 2) Motor Speed values are given in rpm as the actual value minus a speed offset, which is dependant on the Quantima model. For the Q-26, Q-34, Q-43 and Q-52 models the speed offset is 48000 rpm. For the Q-70L model the speed offset is 30000 rpm.

**N.B.** Some software versions incorrectly report the speed values as the actual value, which can cause incorrect readings for certain compressor models. Please check with CompAir to ascertain if you have the correct software version.

- 3) Motor current is given as A x 10, i.e. a reading of 4000 represents 400.0 A.
- 4) All temperature values are given as °C x 10, i.e. a reading of 300 represents 30.0 °C.

## 5.11 Fault Status Codes

This is a numeric code representing the compressor fault status as shown on the compressor's main display. Codes and meanings are as follows:-

Fault Status Codes		
Numeric Code	Meaning	
0	Healthy	
1	Alarm Warning	
2	Shutdown Trip	
3	Sensor Warning	
4	Sensor Trip	
5	No longer used	
6	Link Error Seen	
7	Power Fault	

## 5.12 Control Flags to PLC Word 1 Interpretation

Bit meanings are as follows:-

C	Control Flags to PLC Word 1 Interpretation	
Bit	Meaning	
0	Start Button	
1	Stop Button	
2	Reset Button	
3	Fixed Speed Mode Selected	
4	Compressor Load Allowed	
5	Auto Restart Enabled	
6	Diagnostics Enabled	
7	Cooling Mode Selection	
8	Surge Recovery Enabled	
9	Unused	
10	Bypass Valve Enabled	
11	Set Compressor Defaults	
12	Clear Fault History	
13	Unused	
14	Temperature PID Enabled	
15	Current PID Enabled	

## 5.13 Control Flags to PLC Word 2 Interpretation

#### Bit meanings are as follows:-

Control Flags to PLC Word 2 Interpretation		
Bit	Meaning	
0	System Pressure Control Enabled	
1	Unused	
2	Unused	
3	Energy Efficient Mode Selected	
4	Excess Pressure Differential Target Reduced	
5	Excess Pressure Differential Unload Margin Reduced	
6	RS485 Data Error	
7	RS485 Communications Failure	
8	Unused	
9	Unused	
10	Unused	
11	Unused	
12	Unused	
13	Unused	
14	Unused	
15	Unused	

## 5.14 Status Flags to HMI Word Interpretation

Bit meanings are as follows:-

	Status Flags to HMI Interpretation
Bit	Meaning
0	Compressor Available
1	Remote Start Enabled
2	Surge Detected
3	Auto Restart Active
4	External Load Inhibited
5	Compressor Load
6	Input Power Phase Trip Seen
7	Minimum Speed Recovery Timer Expired
8	Motor Current Sensor Open Circuit
9	System Pressure Sensor Open Circuit
10	Option 1 Input Open Circuit
11	Option 2 Input Open Circuit
12	Remote Start Requested
13	Remote Stop Requested
14	HMI Start Requested
15	HMI Stop Requested

## 5.15 Digital Inputs to HMI Interpretation

#### Bit meanings are as follows:-

	Digital Inputs to HMI Interpretation	
Bit	Meaning	
0	Remote Communications Enable	
1	Emergency Stop	
2	Blower On	
3	Fan On	
4	Auxiliary Equipment Running	
5	VACON Available	
6	AMB Trip	
7	AMB Surge	
8	Intercooler Drain Alarm	
9	After Cooler Drain Alarm	
10	Remote Start Enabled	
11	Remote Unload Enabled	
12	Remote Start	
13	Remote Unload	
14	Input Power Phase Failure	
15	Air Filter Differential Pressure Sensor	

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## 5.16 Optional Analogue Inputs Selection Interpretation

## Bit meanings are as follows:-

Optional Analogue Inputs Selection Interpretation	
Bit	Meaning
0	Unused
1	Unused
2	Unused
3	Unused
4	Use Motor Current Input
5	Use System Pressure Input
6	Use Option 1 Input
7	Use Option 2 Input
8	Unused
9	Unused
10	Reset AMB Trip
11	Unused
12	Unused
13	Unused
14	Unused
15	Unused

## 5.17 Digital Outputs to HMI Interpretation

Bit meanings are as follows:-

	Digital Outputs to HMI Interpretation
Bit	Meaning
0	VACON Start
1	VACON Idle
2	VACON External Fault
3	VACON Reset
4	AMB Reset
5	Water Stop Valve Open
6	Blower Start
7	Bypass Valve Close
8	Compressor Alarm
9	Compressor Trip
10	Compressor Available
11	Start Auxiliary Equipment
12	Compressor Running
13	Compressor Loaded
14	Start Relay
15	Unused

## 5.18 Compressor Inhibit Flags Interpretation

Bit meanings are as follows:-

	Compressor Inhibit Flags Interpretation	
Bit	Meaning	
0	Low Cooling Water Temperature	
1	Stopped by Remote Input	
2	Unused	
3	Unused	
4	Unused	
5	Unused	
6	Unused	
7	Unused	
8	Unused	
9	Unused	
10	Unused	
11	Unused	
12	Unused	
13	Unused	
14	Unused	
15	Unused	

## 5.19 PID Terms

PID Terms are multiplied by 10 to give the monitored value, so a reading of 200 represents a PID term of 20.0.

## 5.20 Quantima Model Codes

A numeric code indicates the Quantima Model as follows:-

Quantima Model Codes		
Numeric Code	Quantima Model	
0	Q-26	
1	Q-34	
2	Q-43	
3	Q-52	
4	Q-70L	

## 5.21 Access Level Codes

The Operator/Service/Commissioning Level is a numeric code indicating the HMI access level with the following values:-

Access Level Codes		
Numeric code	Access Level	
0	Operator	
1	Service	
2	Commissioning	

## 5.22 Operating State First Line Codes

These are numeric codes representing the first line of the Operating Status message displayed on the HMI as shown in the following table:-

Operating State First Line Codes		
Code	Message	
0	Error	
1	Initialisation	
2	Start Inhibit	
3	Ready to Start	
4	Start Inhibit	
5	Standby	
6	Standby	
7	Idle	
8	Offload	
9	Onload	
10	Offload	
11	Stopped	
12	Surge	
13	Surge	
14	Shutdown	
15	Shutdown	
16	Idle - Load Inhibit	

## 5.23 Operating State Second Line Codes

These are numeric codes representing the second line of the Operating Status message displayed on the HMI as shown in the following table:-

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C	Operating State Second Line Codes
Code	Message
0	Error
1	Not Available
2	Available
3	Cooling
4	Minimum Speed
5	Automatic
6	Stopping
7	Fixed Speed
8	Auto Restarting
9	(blank line)
10	Tripped
11	Resetting
12	Cooling
13	Remote Load Inhibit
14	Load Inhibit
15	High Minimum Speed
16	Cooling
17	Full
18	Low Inlet Temperature
19	Remote Stopped
20	Remote Inhibit
21	Unload pressure reduced
22	Target pressure reduced

## 6 Communications Control

This chapter describes the settings and techniques for controlling the Quantima compressor via its communications interfaces.

## 6.1 Commissioning Parameters

- 6.1.1 There are some parameters on the Commissioning Pages that affect the communications control of the Quantima compressor.
- 6.1.2 Commissioning Page 1

There are two parameters on Commissioning Page 1 that affect communications control of the compressor.

Commissioning Param	neters 1
Model:	0-52 VED Spd Max: 1020 Hz
inicaci.	Rated Max Speed: 61200 rpm
Modulation Mode:	Energy Efficient
Impeller Type:	Style 2 Impeller Type
Cooling Type:	Standard
Remote Control Mode	Remote Load
Comms Pressure Con	trol: Delivery Pressure
TIMERS	
Cooling Time:	20 min
Bypass Valve to Open	: 5 sec
Aux Contact Time:	3 sec
Surge Recovery Time:	10 sec
Surge Reset Time:	10 sec
Offloading Time:	5 sec
Parameter Change Enabled	
Menu Home Pag	ge 2 Page 3 Page 4 Page 5

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Fig. 6.1 - Commissioning Page 1

- 1) The parameter named "Remote Control Mode" controls whether the Quantima controller has any influence over the compressor loading or whether the external controller takes load/unload decisions alone. See section 6.6 for full details.
- The parameter named "Comms Pressure Control" determines the source of the control pressure used to control the motor speed. See section 6.5 for details of the options available.

## 6.1.3 Commissioning Page 3

1) The port settings for the ModBus interface, the ModBus address and the communications timeout are accessed on Commissioning Page 3.

Commissioning ETHERNET	Parameters 3		
IP Addressing	Now	Next Powerup	
IP Address	10.0.0.54	10.0.0.54	Change IP
Mask	255.255.255.0	255.255.255.0	Onlange in
Gateway	10.0.0.53	10.0.0.53	
RS485 PORT - Exte	ernal Communica	ations Control	
Configured as Mo	dbus RTU Slave		
Comms Timeout:		5 sec	
Net Slave Number:		1	
Port Settings	Now	Next Powerup	
Baud Rate:	9600	9600	Change settings
Data bits:	8	8	ondingo oottingo
Stop bits:	1	1	
Parity:	none	none	
Parameter Change Enabled Menu Home	Page 1	Page 2 Page	4 Page 5

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## Fig. 6.2 - Commissioning Page 3

- 2) The parameter "Comms Timeout" sets the timeout for establishing whether the external controller has stopped communicating. See section 6.10 for the full description.
- 3) The parameter "Net Slave Number" is the ModBus address for the compressor. Note this parameter has no effect on the ProfiBus address.
- 4) The parameters under "Port settings" are the settings for the ModBus serial port. Pressing the "Change settings" button on the right can change these. Changes to the port settings do not take effect until the HMI panel has been restarted.

## 6.2 Communications Control Enable

6.2.1 To enable communications control, it is necessary to connect the Quantima PLC digital input X13 to 24V DC. This can be wired permanently or via a switch or relay contact, allowing the Quantima to be switched between local and communications control. The status of the communications control enable input can be monitored via the compressor status word (see section 6.11).

#### 6.3 Compressor Start/Stop

- 6.3.1 The Quantima compressor does not provide any method of starting or stopping the motor via its communications interfaces. Once the compressor has been started from the HMI, the Quantima controller will start and stop the motor as required. Due to the design of the Quantima compressor it is not necessary to start and stop the motor to reduce wear and tear.
- 6.3.2 In the event of a power failure the Quantima provides an "Auto Restart" facility to make the compressor available when the power returns. This has the same effect as pressing the Start button on the HMI. The auto restart facility is enabled from the Service menu. There is also an auto restart timer that delays the auto restart action and can be used to synchronise the Quantima with an external controller.

#### 6.4 Control Methods

- 6.4.1 There are two methods of control available via the Quantima communications interfaces: pressure control and speed control. The selection of pressure or speed control is controlled by the compressor control word described in section 6.11.
  - For pressure control, the communications device supplies the load, unload and target pressures to the Quantima. Optionally, a communications pressure value can be supplied. The Quantima controller controls the motor speed based on the target and control pressure (the choice of control pressure is described in section 6.5). Loading and unloading of the compressor can be controlled either by the Quantima controller in concert with the external controller or solely via the communications interface. The selection of the compressor loading control is described in section 6.6.
  - 2) When using speed control, the communications device directly controls the motor speed of the Quantima. This is an advanced control method that requires in-depth knowledge of how the Quantima compressor operates. System controller designers who wish to use this control method must discuss their requirements with the CompAir technical department who can provide the necessary advice and support.

#### 6.5 Control Pressure Selection

- 6.5.1 When using the pressure control method (see section 6.4) there is a choice of the pressure signal that is used to control the motor speed. This choice is between a pressure value supplied over a communications interface, the delivery pressure measured by the compressor and a pressure reading from an external sensor. On Commissioning Page 1 (see section 6.1) the parameter "Comms Pressure Control" has two options, "Delivery Pressure" (the default setting) and "Comm Pressure".
  - If this parameter is set to "Comm Pressure" the Quantima controller will use the pressure value supplied via the communications interface to control the motor speed.
  - If this parameter is set to "Delivery Pressure", motor speed control by the Quantima controller will use either the delivery pressure measured by the compressor or a pressure reading from an external sensor.
  - 3) To use the pressure reading from an external sensor, first that sensor must be connected to the Quantima controller. Refer to the Quantima wiring schematic Q009-9002 for the connection details. The sensor must then be configured on Commissioning Page 4. The parameter "System Pressure" must be enabled and the settings for the pressure range entered.

Input A5	Conn SL4-1	Designation Motor Current			In Use Yes	Units A
Range	41	mA 0.0 A	20mA	614.0A		
A6 Range	SL4-2 41	System Pressure mA 0.00 bar	20mA	16.00 bar	Yes	bar
A7	SL4-3	Option 1			No	
A8	SL4-4	Option 2			No	
Parameter C	hange Enab	ne Page 1	Page	2 F	age 3	

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Fig. 6.3 - Commissioning Page 4

4) Once the external pressure sensor is configured on Commissioning Page 4, the choice of using the delivery pressure or the external sensor is made on the "Pressures" page accessible from the Service Menu. The parameter "System Target Pressure in Use" determines which pressure reading is used. When set to "No", the Quantima controller uses the delivery pressure. When set to "Yes" the controller uses the external sensor.

PRESSURES		Alarm	Trip
Stage 2 Inlet:	1.91 bar	4.00	4.50
Plant Delivery:	4.21 bar	4.70	5.10
System Pressure:	1.60 bar	8.00	8.60
Pressure Settings			
For Del P Modulation:	Unload P Margin:		0.20 bar
	Target Pressure:		4.00 bar
	Load Pressure:		3.70 bar
For System P Modulation:	Unload P Margin:		0.50 bar
	Target Pressure:		7.50 bar
	Load Pressure:		7.00 bar
	System Target Pres	sure in Us	e No
Parameter Change Enabled		Γ	01
Menu Home	Previous Timers C	ounters	Stop

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## Fig. 6.4 - Select Between Delivery And External Pressure

## 6.6 Local and Remote Loading Control

- 6.6.1 As mentioned in section 6.1, there are two methods of controlling when the Quantima compressor loads and unloads. The choice between these two methods is made on Commissioning Page 1 using the parameter "Remote Control Mode".
  - When the parameter is set to "Local Load" the Quantima controller will load and unload according to the operating mode described in section 6.7. The external controller can inhibit loading using the control word (see section 6.11) but cannot force the compressor to load. This is the easiest and most reliable control option as it allows the Quantima to load and unload according to the control pressure value and allows the external controller to inhibit loading when the compressor is not required. It is recommended that external controllers use this control method.
  - 2) With the parameter set to "Remote Load", the Quantima controller hands over all decisions on loading and unloading to the external controller. The external controller can command the compressor to load even when the Quantima would not do so according to its operating mode. Misuse of this facility may

cause the compressor to behave erratically. Excessive load/unload cycles will cause increased fatigue stress on the compressor impellers and a decrease in service intervals. Designers of external controllers should only use this control method if they fully understand the implications of taking control in this manner and should contact CompAir technical support for additional advice.

## 6.7 Operating Mode

The Quantima compressor has two modes of operation that affect when it goes on and off load. When using communications control, these modes are selected via the communications channel if the control method (section 6.4) is pressure control and the loading control (section 6.6) is local loading. Section 6.11 describes the control word option for selecting the operating mode. The two operating modes are called Classic and Energy Efficient. There are three pressure levels that are important to the operating mode; the load, target and unload pressures.

## 6.7.1 Classic Operating Mode

 In the Classic operating mode, the Quantima will go on load when the Control pressure (see section 6.5) falls below the load pressure. The compressor remains loaded until the motor speed drops below the minimum speed allowed. The compressor goes off load until the Control pressure falls below the load pressure again. The unload pressure is also used as an upper safety limit to unload the compressor.

## 6.7.2 Energy Efficient Operating Mode

 In Energy Efficient operation, the Quantima will go on load when the Control pressure falls below the target pressure. The motor speed is maintained above the minimum speed and the pressure is allowed to increase up to the unload pressure. The compressor then goes off load until the control pressure falls below the target pressure.

## 6.8 Compressor Surging

6.8.1 The Quantima is a turbo compressor and as such it is subject to a phenomenon called surging. In a normal turbo compressor this condition is avoided due to the damage it can cause. The design Quantima, however, allows it to detect the surge condition and react appropriately and safely. The Quantima controller permits the compressor to surge periodically and uses data from the surge to determine a suitable minimum speed. The compressor can also surge at other times if the ambient conditions change or there is a disturbance in the air system. An external controller can tell if a deliberate surge is likely using the compressor status word, see section 6.11. Similarly, a controller can detect when the Quantima is in a surge condition from the status word. During a surge episode, the compressor is off load but will normally return on load after the surge has cleared provided the conditions for loading are met and the external controller permits the Quantima to go on load.

## 6.9 Compressor Start Time

6.9.1 The Quantima is a high-speed compressor. This means there is a noticeable acceleration time required to achieve the necessary motor speed before the compressor goes on load. The time from stationary to on load is 25 seconds and this must be taken into account by an external controller.

## 6.10 Communications Timeout

6.10.1 The Quantima controller implements a timeout on the communications to determine if the external controller has stopped communicating. This timeout is set on Commissioning Page 3 (see section 6.1). If no valid command is received from the external controller within this timeout period the Quantima will generate an alarm. If three consecutive timeout periods pass with no valid communications, the Quantima will revert to local control. When valid communications resume the Quantima will return to communications control.

## 6.11 Communications Data

6.11.1 The Quantima controller makes a block of data available to an external controller that incorporates everything required for successful control. Similarly, the Quantima accepts a block of data from the external controller that has all the values required to operate the compressor. Both blocks are available via ModBus or ProfiBus. All data is in 16 bit words. The following two tables list the ModBus addresses and ProfiBus offsets and the data read from or written to those addresses. A detailed description of the data follows the two tables.

Data Read From The Compressor			
ModBus Address	ProfiBus Offset	Data	
400001	0	Compressor Status Word	
400002	2	Motor Speed	
400003	4	Minimum Speed	
400004	6	Delivery Pressure	
400005	8	Hours Run (low word)	
400006	10	Communications Command Echo	
400007	12	Operating State	

Data Written To The Compressor			
ModBus Address	ProfiBus Offset	Data	
400020	0	Compressor Command Word	
400021	2	Requested Speed	
400022	4	Communications Pressure	
400023	6	Target Pressure	
400024	8	Load Pressure	
400025	10	Unload Pressure	

6.11.2 The Compressor Status Word indicates the status of the Quantima compressor. The meaning of each bit of the status word is described in the following table.

	Compressor Status Word Interpretation		
Bit	Description		
0	Communications Control Enabled. The status of the digital input used to enable communications control is reflected in this bit, see section 6.2		
1	Unload Input Enable. This bit reflects the status of the digital input used to enable compressor unloading via a digital input. The unload input is used to force the compressor off load even when the conditions for loading are met.		
2	Start/Stop Input Enable. This bit reflects the status of the digital input used to enable compressor start/stop via a digital input.		

	Compressor Status word Interpretation
Bit	Description
3	Compressor Available. The Quantima compressor is available whenever it has been started and is not in a tripped condition. The external controller can initiate loading whenever the compressor is available. If the compressor is available on a power failure and Auto Restart is enabled (see section 6.3) the compressor all automatically start when power is applied. The compressor will not be available during the auto restart time to allow an external controller to establish initial communication.
4	Compressor On Load. Indicate the compressor is on load and supplying air to the system.
5	Compressor In Surge. Indicates the compressor is in a surge condition. During a surge condition the compressor remains available. After recovery from the surge condition the Quantima will return on load if the loading conditions are met and the external controller permits loading.
6	Compressor Alarm. The Quantima controller has detected an alarm condition. An alarm condition does not stop the compressor from operating but indicates attention is required. The exact alarm condition can be determined from the monitoring parameters and is displayed on the compressor's HMI.
7	Compressor Trip. The compressor has encountered a trip condition and has shut down to prevent damage or incorrect operation. The exact trip condition can be determined from the monitoring parameters and is displayed on the compressor's HMI. Action must be taken to remedy the fault and the compressor restarted before it can be used again.
8	Requested Speed below Minimum Speed. The requested speed is below the minimum speed and has been adjusted upwards accordingly.
9	Requested Speed above Maximum Speed. The requested speed is above the maximum speed and has been adjusted downwards accordingly.
10	Minimum Speed Recovery Timer Expired. As described in section 6.8, the Quantima controller will allow the compressor to surge periodically. A timer known as the Minimum Speed Recovery Timer controls this behaviour. This bit indicates the timer has expired and the compressor will be allowed to surge. An external controller can use this when deciding if to unload a compressor.

Compressor Status Word Interpretation				
Bit	Description			
11	Target Pressure Reduced. If the compressor delivery pressure exceeds the maximum target pressure value, the target pressure is reduced to protect the compressor. This bit indicates this action has been taken.			
12	Unload Pressure Reduced. If the compressor delivery pressure plus the unload pressure margin exceed the maximum unload pressure, the upload pressure is reduced to protect the compressor. This bit indicates this action has been taken. (The unload pressure margin is the unload pressure minus the target pressure.)			
13	Communications Data Error. An incorrect value has been received in the communications data from the external controller.			
14	Compressor Running. This bit indicates the compressor motor is running. It is possible to load the compressor regardless of whether the motor is running or not.			
15	Configured Operating Mode. This bit indicates the compressor operating mode as configured in the Commissioning parameters. A value of 0 indicates Classic mode, a value of 1 indicates Energy Efficient mode.			

6.11.3 The Compressor Control Word is the commands sent to the compressor from an external controller. The meaning of each bit of the control word is given in the following table.

Compressor Control Word				
Bit	Description			
0	Not used			
1	Control On/Off. This bit indicates to the Quantima compressor that the external controller has control of the compressor. When the controller is set to the pressure control method (section 6.4), this bit is only acted upon if the loading control method is set to local (section 6.6). When using the speed control method this bit is always acted upon. A value of 1 indicates the external controller is in control.			
2	Load/Unload. The function of this command bit varies depending on the loading control method (see section 6.6). For local loading, this bit acts as a load inhibit - a value of 1 will prevent the compressor from loading. For remote loading control, this bit is the load/unload control. A value of 0 causes the compressor to go on load; a value of 1 causes the compressor to unload.			

Compressor Control Word				
Bit	Description			
3	Pressure Control Enable. Selects the pressure control method (see section 6.4).			
4	Speed Control Enable. Selects the speed control method (see section 6.4).			
5	Communications Operating Mode. When the loading control method (section 6.6) is set to local loading, this bit determines the operating mode used (see section 6.7). A value of 0 selects classic mode, a value of 1 selects energy efficient mode. <b>Note</b> : This mode can be different from the operating mode configured in the Commissioning parameters.			
6	Not used			
7	Not used			
8	Not used			
9	Not used			
10	Not used			
11	Not used			
12	Not used			
13	Not used			
14	Not used			
15	Communications Watchdog. This bit is used by the communications timeout function (see section 6.10). A value of 0 must be written repeatedly to this bit to prevent the timeout.			

Control Word bits 3 and 4 select the control mode for the communications control. These bits interact according to the following table:-

Control Mode Selection						
Control Word Bit 4	Control Word Bit 3	Control Mode				
0	0	Compressor operates in local control mode.				
0	1	Compressor operates in communications pressure control mode.				
1	0	Compressor operates in communications speed control mode.				
1	1	Compressor operates in local control mode.				

6.11.4 Motor Speed, Minimum Speed and Requested Speed. All speed values are given in rpm as the actual value minus an offset that depends on the Quantima model. For the Q-26, Q-34, Q-43 and Q-52 models the offset value is 48000 rpm. For the Q-70L model the offset is 30000 rpm. Thus, for a Q-52 Quantima, a speed reading of 12000 equates to an actual speed of 60000 rpm.

- 1) The Motor Speed is the actual speed of the motor, as long as that speed is greater than the offset described above.
- 2) The Minimum Speed is the minimum speed that can be requested of the motor. This is dependent on the compressor delivery pressure and the ambient conditions. The minimum speed is recalculated periodically by allowing the compressor to surge. In the Classic control mode, the compressor will unload if the motor speed falls below the minimum speed.
- 3) The Requested Speed is the speed an external controller requires the compressor to run at when using the speed control method (see section 6.4). This value is also subject to the offset described above, so to request a speed of 49000 rpm for a Q-70L compressor needs a requested speed of 19000. The speed value requested is checked against the minimum and maximum speeds and is adjusted accordingly.
- 6.11.5 Delivery Pressure, Communications Pressure, Target Pressure, Load Pressure and Unload Pressure. All pressure values are given as 100 times the actual pressure value in bar. For example, a delivery pressure of 6.87 bar would be read as 687. When using pressure control, the Quantima controller will check the load, target and unload pressure values and will revert to local control if any value is zero. If the communications pressure is selected as the Control pressure this is also checked against the compressor limits before use.
  - The Delivery Pressure is the pressure measured by the Quantima just after the non-return value at the compressor outlet.
  - 2) The Communications Pressure is the pressure value supplied by the external controller and is used as the Control Pressure when selected in the commissioning options (see sections 6.1 and 6.5).
  - The Load Pressure is the pressure below which the compressor will initiate loading in the Classic control mode.
  - 4) The Target Pressure is the desired pressure that the compressor is trying to maintain. The Quantima controller will modulate the motor

speed to make the Control pressure equal to the target pressure.

- 5) The Unload Pressure is used to unload the compressor when the Control pressure exceeds the unload pressure. This applies to both operating modes.
- 6.11.6 The Hours Run value is the low word of the Quantima running hours counter. This can be used for usage levelling over a number of compressors. The full running and on load hours can be obtained from the monitoring parameters.
- 6.11.7 The Communications Command Echo is simply a copy of the Communications Command Word written to the compressor.
- 6.11.8 The Operating State is the current operating state of the Quantima compressor. The values have the same meanings as given in section 5.9.