DCM

Product Brochure

BIFFI

tyco flow control

Diagnostic Communication Master

DCM

The DCM Diagnostic Communication Master is the best solution for the control of actuators from a remote control room through a two-wire transmission-mode bus communication system.
Designed and engineered by Biffi, the DCM integrates the highest experience in actuation technology with the flexibility and operative reliability of an open and standard bus communication protocol: LONWORKS®.

The proven technology and design of the DCM can easily meet the requests of modern networks and can ensure reliable data communication in the severest operative conditions; this unit offers as a plus the possibility of being integrated or retrofitted with any other devices using the LONWORKS® protocol.

DCM: technical description

The DCM system is composed of three main elements: the master station itself (single or redundant), the fields units (i.e. actuators or other devices installed on-field) and the two-wire loop cables.

The main purposes of the DCM system are:

- ❑ To interconnect field devices (i.e. BIFFI actuators series ICON and ICON2000 with LONWORKS® interface card) with the superior control level in the system (i.e. DCS or PLC) through a MODBUS RTU interface card;
- ❑ To perform, through the user-friendly operator interface panel, all the necessary control and maintenance operations for the plant, with detailed graphic pages for each specific device under control;
- ❑ To set up the fieldbus configuration with all the functions for the management of each single device. With DCM no additional tools or software are required.

Each single device connected within a network is called “node”. The DCM is designed to control up to 250 nodes.

Please refer to the table below for the maximum capacity for each type of node:

Name	Description	DCM Capacity
ICON	Intelligent Control System Unit integrated in BIFFI C and QTC actuators series	Up to 250(1)
ICON2000	Second-generation multi-turn intelligent actuator	Up to 250(1)

(1) an NCD device is required every 60 actuators

Each node requires a different allocation in the DCM memory and consequently the DCM maximum capacity is strictly related to the type and numbers of nodes connected within the network.

The DCM accepts optional memory expansion whenever a particular application requires to connect several nodes to the same network.

Key features

Ethernet connectivity:

- On-board Ethernet with standard TCP/IP;
- Integrated 2 ports switch on CPU to connect a Master DCM to a Slave DCM and a PC;

Modbus lines:

- Performances are not influenced by the serial lines activity;
- Each MODBUS line manages independent 12 bits scaling on the MODBUS analogue registers;

The DCM transfers all the information from the field and from the same DCM to the higher lever of the control system (DCS or SCADA). This function gives total control of the plant. Data are transmitted, by MODBUS RTU communication protocol, through two completely independent serial lines so as to obtain a redundant connection.
The MODBUS interface is obtained with the data contained in a configuration file: these data are relevant to the variables transmitted with each actuator and to the actuator physical sequence on MODBUS map. The MODBUS interface is no way linked to the physical connections of the nodes in the field.

"Group" management

An innovative node management system, defined "by groups", was introduced for easier control of the field devices connected to a DCM. With this functionality, the devices connected to the DCM can be grouped into homogenous wholes (i.e. the actuators in the pump room, or in another area of the plant) and be displayed as such on the DCM screen.
This system allows to logically break a complex network down into smaller, easily controllable systems. With groups management it is possible to have a modular and flexible vision of the whole system in a way which is totally independent of the physical connection of the nodes within the field.

With group management it is possible to simultaneously send configuration commands to all the devices in the same group.

Access to the system - Login
The access to the DCM pages and the availability to the command operation is regulated by an access control system based on the identification of the operators through password control (login).

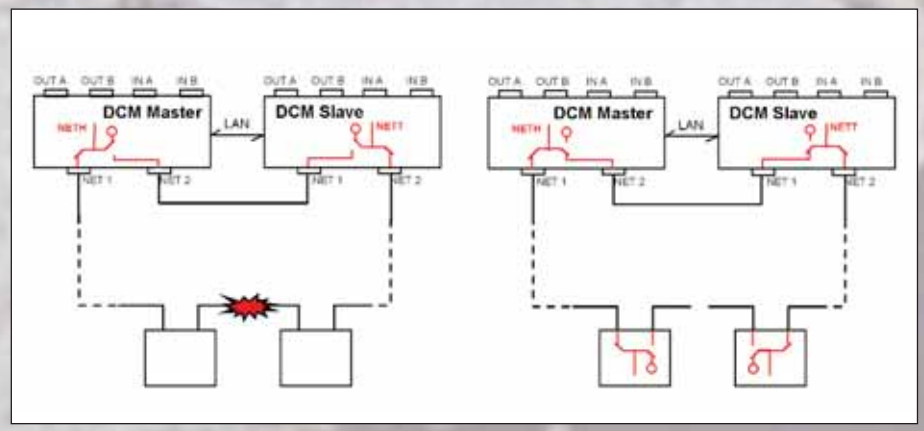
The DCM considers the following four operators:

OBSERVER	Can access page visualisation with no possibility of sending commands or making any modifications. No password required.
OPERATOR	Responsible of process operation; can send commands to all the connected devices. For example, the Operator can enter the ICON menu and send a Close command.
MAINTAINER	Responsible of process maintenance; can access all operation commands and configure the connected devices. For example, the Maintainer can enter the ICON configuration page and modify some parameters.
ADMINISTRATOR	Has the full control of the plant and manages the operation, maintenance and communication network. The Administrator can modify the communication network by adding or removing nodes, or by modifying the groups. The Administrator decides for the functionality and login of all the other operators.

The Login access system forces each operator to identify himself with the DCM before each operation.

Loop Integrity Control

The DCM allows to check the loop integrity by a very sophisticated system based on the reconstruction of the nodes cabling physical sequence.
By an automatic procedure, the DCM creates the physical list for each communication loop; the cabling sequence of the nodes is independent of the MODBUS map and of the organisation of the groups.

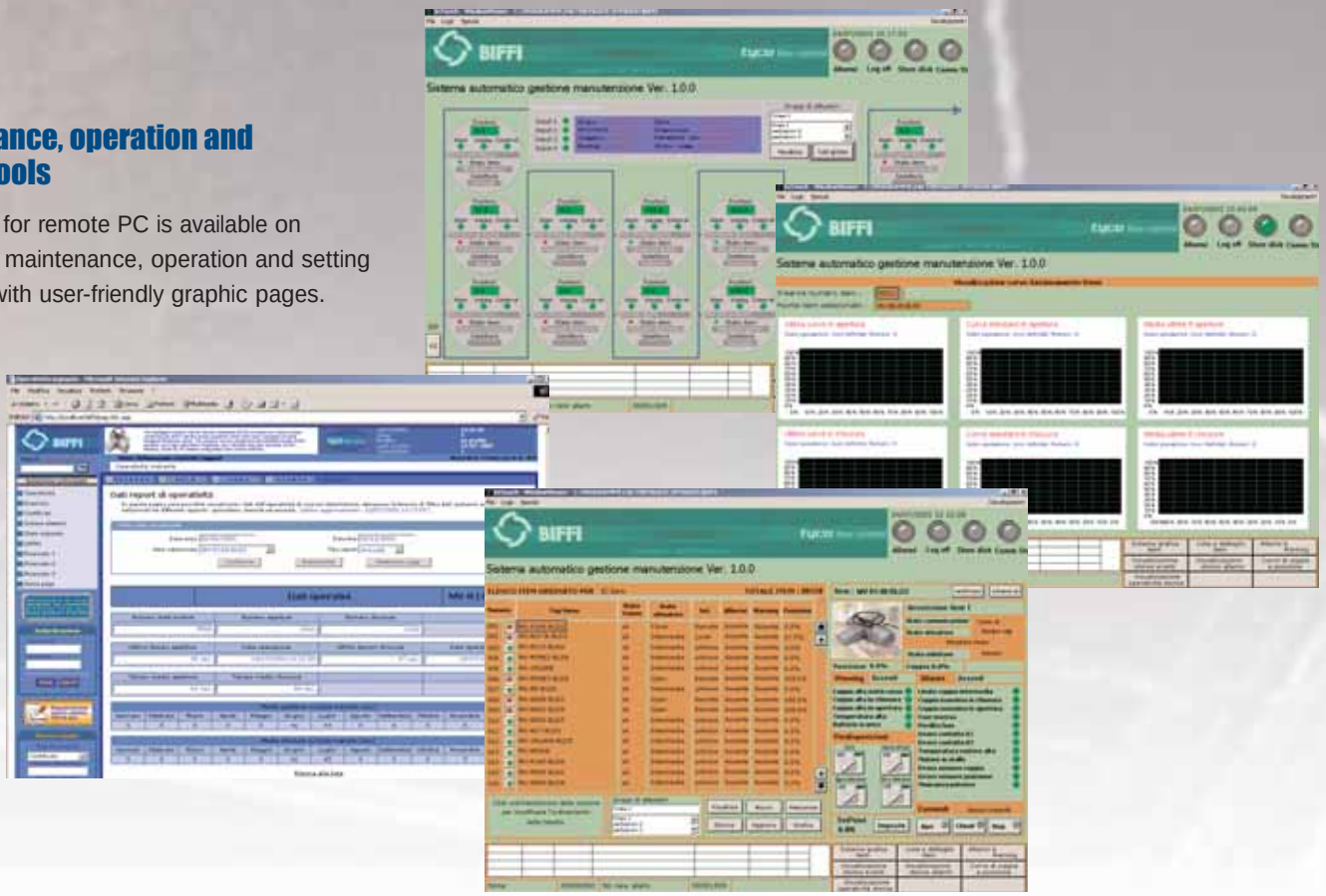


Once the sequence is defined, the continuity control is managed by the nodes placed on the loop extremity inside the DCM station. It is thus possible to have a control independently by the DCM.

When communication is interrupted, whether by a cut cable, ground connection or short circuit between bus cables, the DCM operates the network terminators as closest as possible to the fault origin and creates a connection between all the still communicating nodes.

Maintenance, operation and setting tools

A software for remote PC is available on request for maintenance, operation and setting purposes with user-friendly graphic pages.



LONWORKS® Network Platform – Quick Technology Overview

In almost every industry today, there is a trend away from proprietary control schemes and centralised systems. Manufacturers are using open, off-the-shelf chips, operating systems and parts to build products that feature improved reliability, flexibility, international proven record, system cost and performance.
LONWORKS® technology is accelerating this trend by providing interoperability, robust technology, faster development and scale economies.
Devices in a LONWORKS® network communicate using LonTalk, the standardised language of the network. LonTalk consists of a series of underlying protocols that allow intelligent communication among various devices on a network.

The protocol provides a set of services that allows the application program in a device to send and receive messages from other devices over the network with no need to know the topology of the network nor the names addresses or functions of other devices.

Support for network management services allows for remote network management tools to interact with devices over the network, including reconfiguration of network addresses and parameters, downloading of application programs, reporting of network problems, and start/stop/reset of device application programs.

LonTalk – and thus LONWORKS® networks – can be implemented over basically any medium, including power lines, twisted pair, radio frequency (RF), infrared (IR), coaxial cable and fiber optics.

Install a control network

A control network is a group of devices (“nodes”, each with one or more sensors or actuators, plus localised computational capability), that communicate with each other over one or more media, using a standard protocol, to implement a control or monitoring system.
Communication among nodes may be peer-to-peer (distributed control) or master-slave (centralised control); in either case, intelligence in the nodes (computational capability) allows the distribution of processing loads (sensors can be intelligent, for example, performing local data analysis, conversion, & normalisation, and reporting only significant changes in their environment). If the control functions are also distributed, both system performance and reliability can be dramatically enhanced.

LONWORKS® Platform

LONWORKS® is a networking platform created by Echelon. LONWORKS® networks describe a complete solution to the problem of control systems.
A networked control system is significantly more powerful, flexible, and scaleable than a non-networked control system, and businesses can save and make more money building control networks over the long term than they can with non-networked control systems.
LONWORKS® technology provides a solution to the many problems of designing, building, installing, and maintaining control networks: networks that can range in size from 2 to 32,000 devices and can be used in several application fields.

Basic Technology Suppliers

The main suppliers of LONWORKS® networks are:
- Echelon Corporation – the LonPoint System, development tools, transceivers, network management tools, support and training (creator of the technology, and provider of transceivers, connectivity products, development tools and training)
- Cypress Semiconductor (beginning year 2000) and Toshiba – Neuron chips (competing world-wide suppliers of variously packaged versions of the Neuron chip)

Additionally there are over 4000 LonWorks® developers world-wide supplying everything from transceivers to network management tools, to interfaces, to end-users products and systems.

Integrated provisions for reliability

Reliable delivery is provided by using end-to-end acknowledgements made possible by the use of a seven layer OSI stack, 16-bit cyclical redundancy checks, watchdog timers, and, in the case of certain transceivers, the use of error correction algorithms.

Performance predictability

An integral part of the protocol used in LONWORKS® networks is its unique media access technique, termed "predictive persistent CSMA, with optional priority and collision detection". It provides linear response to offered traffic load, predictable response time for heavily loaded networks, and consistent performance independent of network size.

Four Benefits of Interoperability

Interoperable products allow project engineers to specify best of breed systems rather than be forced into using one vendor's entire line of products.
Interoperable systems allow plant managers to monitor facility while using standard tools, regardless of which company made a particular sub-system.

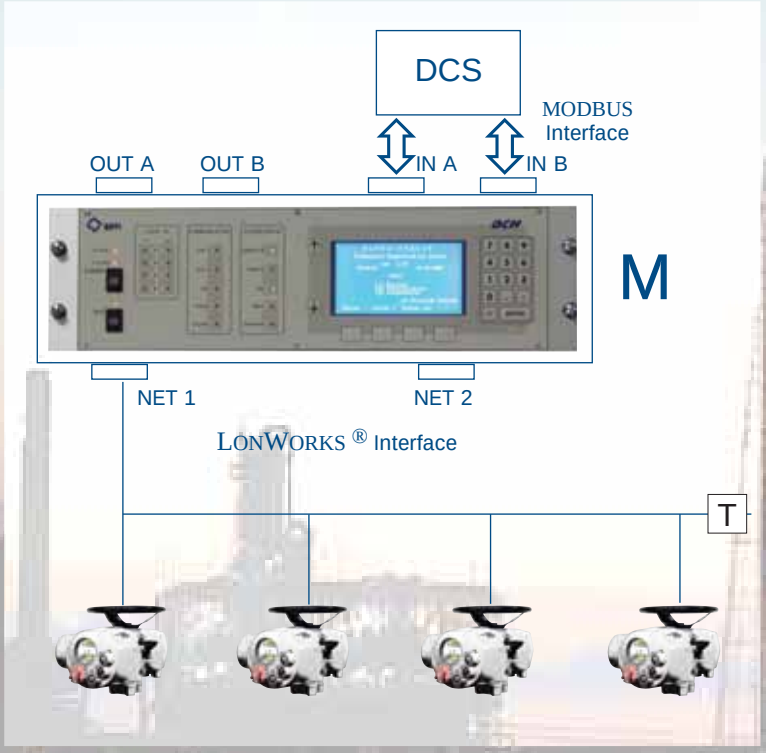
Data available from the field units

For each ICON actuator, the following data is available:		
Commands	CLOSE	
	OPEN	
	STOP	
	ESD	
	INCHING MODE	When active, the actuator follows the set-point
	SET-POINT	
	VALVE CLOSED	
	VALVE OPEN	
Signals	VALVE OPENING	
	VALVE CLOSING	
	ALARM SUMMARY	a summary signal of all alarms
	SELECTOR IN “LOCAL”	signals when the selector is in “LOCAL”
	SELECTOR IN “OFF”	signals when the selector is in “OFF”
	SELECTOR IN “REMOTE”	signals when the selector is in “REMOTE”
	ESD ACTIVE	
	POSITION %	
	TORQUE %	
	DETAIL OF THE WARNINGS	Command interrupted by local STOP Current torque near to max. in mid position Current torque near to max. in opening Current torque near to max. in closing Electronic card temperature exceeded Battery low
	DETAIL OF THE ALARMS	Push-button error Torque limit exceeded at intermediate position Close torque limit exceeded Open torque limit exceeded Wrong phase sequence (if auto-correction mode is disabled) Phase missing K1 contactor failure K2 contactor failure Motor high temperature Motor in stall condition Torque sensor failure Position sensor failure Communication error

Working principle

1. Single station with a non redundant bus

Normal mode	The DCS is connected to lines A or B; Station M is active and communicates with the field.
Bus Interrupted	M cannot communicate with all the field units therefore its image of the field is no longer complete; M continues to exchange the available data with the DCS.
M out of service	The DCS cannot communicate with the field
Restarting of M	M regains control when it is no longer out of service i.e. after the intervention of the operator that removes the fault or once its cause disappears (e.g. power returns after it was missing)
Lines A and B	both lines are simultaneously active so the DCS can use indifferently either of them



2. Single station with a redundant bus

Normal mode	The DCS is connected to lines A or B; Station M is active and communicates with the field; Station M, together with the field units, continuously verifies the loop integrity.
Bus Interrupted	M cannot communicate with all the field units therefore its image of the field is no longer complete; the field units closest to the bus fault isolate the interrupted portion of the line and recover a correct termination of the loop; M can resume a correct communica tion with all the nodes, updating once again its image of the field; M continues to exchange the available data with the DCS.
M out of service	The DCS cannot communicate with the field
Restarting of M	M regains control when it is no longer out of service, i.e. after the intervention of the operator that removes the fault or once its cause disappears (e.g. power returns after it was missing)
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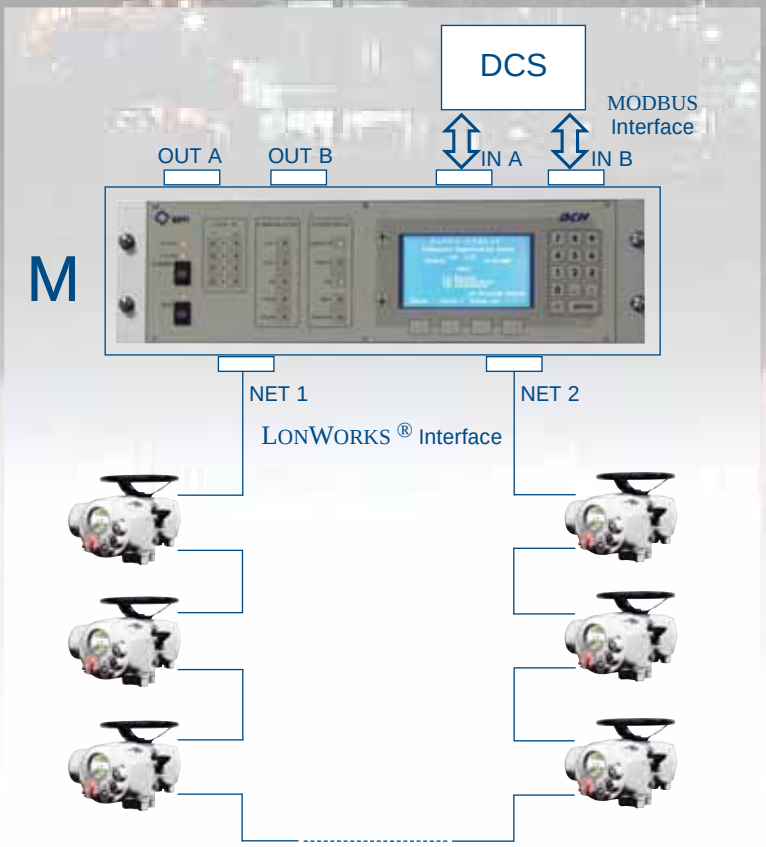
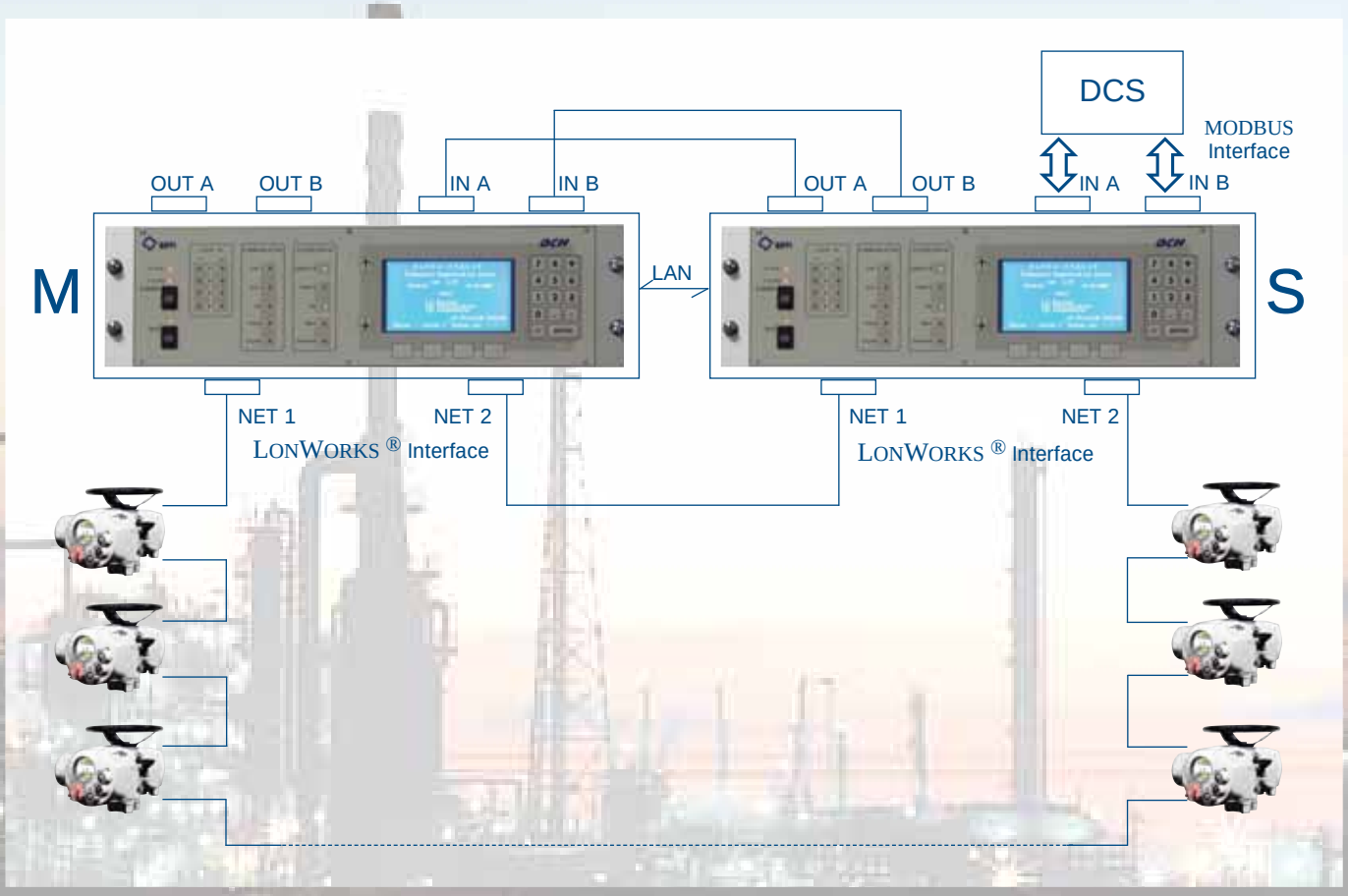
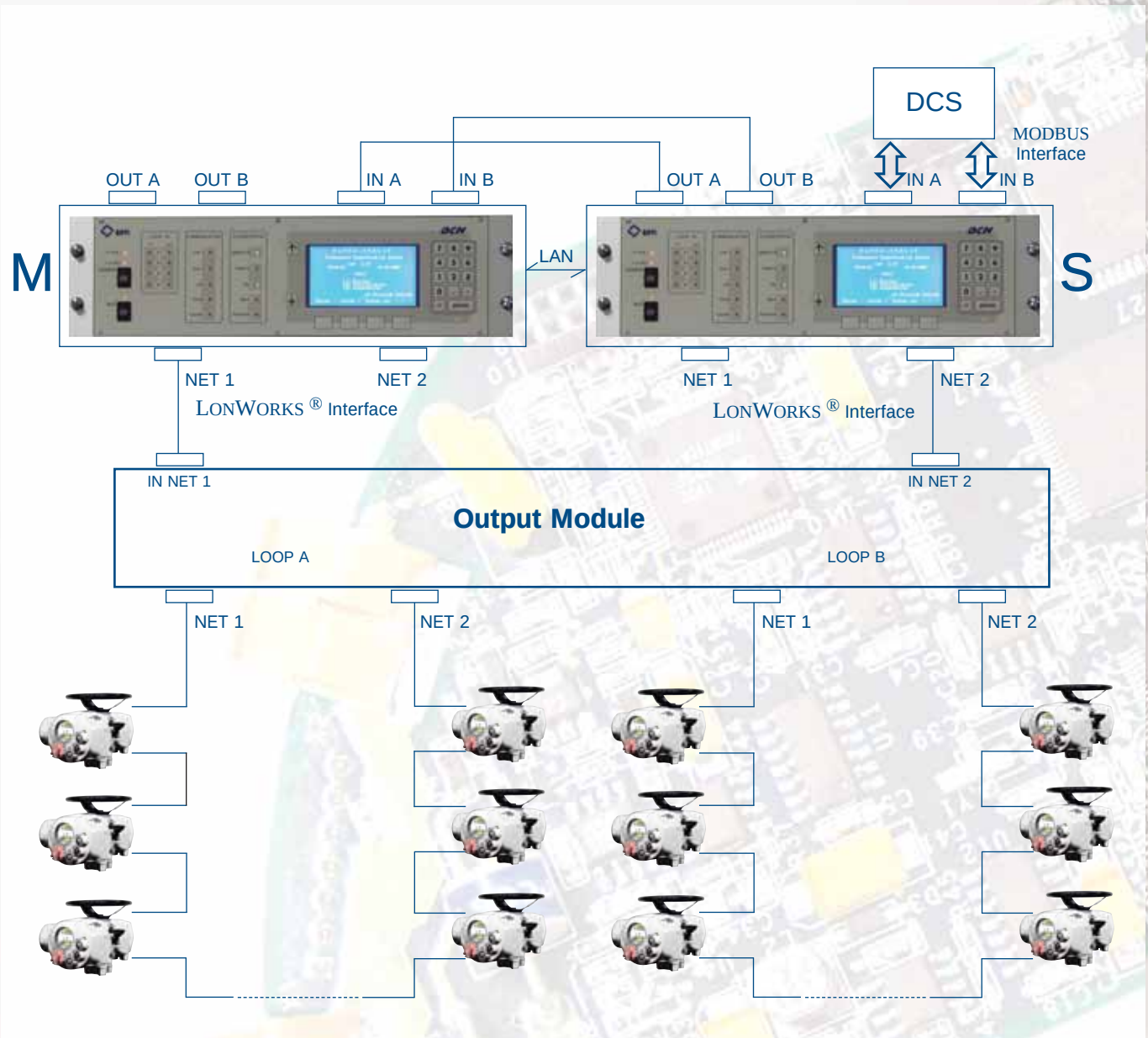


3. Master (M) and Slave (S) stations in hot back up with a redundant bus



Normal mode	The DCS is connected to lines A or B; Station M is active and communicates with the field; Station S does not interrogate the field; Station S maintains its image of the field updated; S verifies the correct operation of M. M and S, together with the field units, continuously verify the loop integrity.
Bus Interrupted	M cannot communicate with all the field units therefore its image of the field is no longer complete; the field units isolate the interrupted portion of the line and recover a correct termination of the loop; M can resume a correct communication with all the nodes, updating once again its image of the field; M still remains the only unit that exchanges data with the DCS.
M out of service	Station S, that controls the correct operation of M, determines that M is out of service due to one of the following causes: - communication errors - non consistent data - an explicit message from M. When S takes control: - it switches lines A and B onto itself - it switches the line for the external terminal - it turns on a local indication - it deactivates M. The DCS recognises that S is active from the internal registers of the DCM
Restoration of M	the control returns to M only after an explicit consent: - from the DCS upon writing an appropriate register - from the local interface through a command in an appropriate menu After receiving the consent, S verifies the good condition of M; if necessary, S reloads the configuration into M and waits that M is ready to work; S returns the control to M and goes back to stand-by mode
Lines A e B	both lines are simultaneously active so the DCS can use indifferently either one; the station that is currently active (M or S) will reply on the same line; each station (M or S) signals any fault of its own serial lines A and B via LEDs.

4. Master (M) and Slave (S) stations in hot back up with a redundant bus on various loops



The network can comprise various loops as long as the maximum number of nodes (250) is not exceeded.
The principle of operation is identical to the previous case, therefore M and S work in the same way.
In this case the DCM is equipped with Output Modules that allow the system to work with a multiple loop structure.

Housing

The DCM is housed in a 19” - 3HE rack for cabinet mounting.
Dimensions: width: 480mm; height: 132mm; length: 300mm
Weight: 8 Kg

Front panel:

Rear panel:

Technical Features

Power supply: 24 Vdc
115 Vac, 120 Vac 50/60 Hz
230 Vac, 240 Vac 50/60 Hz

Power: 50VA

Power supply protection: resettable fuse (MultiFuse protector type)

Power Supply Output: 12 Vdc out 12 [V] +10/-20% @0.5 [A]

Working temperature: 0÷50°C

Local digital inputs: Four opto-isolated inputs
Minimum input isolation: 500 Vdc
Mimimum voltage input high: 4.75 Vdc
Maximum voltage input low: 0.2 Vdc
Maximum input voltage: 24 Vdc
Isolated 12 Vdc available at the 12 Vdc
out terminal on the rear panel of the Station

Local digital outputs: Four volt-free contacts, normally open
Nominal resistive load: 0.5A @ 110 Vac, 1A @ 24 Vdc
Maximum working voltage: 125 Vac, 60 Vdc
Output isolation: 400 Vdc

Communication ports:

Line A

Serial line:	RS232 or RS422 or RS485
Protocol:	Modbus RTU
Baud rate:	9600, 11200, 38400
Bit number:	7; 8
Parity:	None, Even, Odd
Stop Bit:	1; 2
RS232 line:	Tx, Rx, RTS, CTS, GND
RS422 line:	Tx+, Rx+, Rx-, Tx-, Shield; Termination
RS485 line:	Tx, Rx, Shield; Termination

Line B

Serial line:	RS232 or RS422 or RS485
Protocol:	Modbus RTU
Baud rate:	9600, 11200, 38400
Bit number:	7; 8
Parity:	None, Even, Odd
Stop Bit:	1; 2
RS232 line:	Tx, Rx, RTS, CTS, GND
RS422 line:	Tx+, Rx+, Rx-, Tx-, Shield; Termination
RS485 line:	Tx, Rx, Shield; Termination

Configuration

Serial line:	RS232
Baud rate:	38400
RS232 line:	Tx, Rx, RTS, CTS, GND

LAN

Serial line:	Ethernet 802.3 10 Base-T; Hub 2 ports
Protocol:	TCP/IP

Field bus port: Protocol: LONWORKS®
Transmission media:
- Twisted pair @ 78 Kbit/sec (standard)
- Twisted pair @ 1.25 Mbit/sec x w 4

Local display: Monochrome graphic display:
- Text mode: 40 characters x 16 lines
- Graphic mode: 240x128 pixel
Visible area 114mm x 64mm
Contrast keyboard adjustable

Local keyboard: Front panel integrated keyboard
16 keys
4 multifunction ‘soft keys’

LED indications: 4 greed LEDs: status of available inputs
4 green LEDs: output status
5 red LEDs: serial lines status
2 red LEDs: power available
1 red LED: bus active
5 various LEDs: DCM status

External supply protecion: 5x20 fuse, 250 V, 2 A, fast acting

Internal supply protection: resettable fuse (MultiFuse protector)

Battery: 2 x 1.5 V alkaline battery, AA type
Batteries keep the internal clock updated even if power supply is missing.
IMPORTANT: it is recommended to change the batteries every 3 years. This operation must be carried out while the DCM unit is powered.

BIFFI

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COMPANY
WITH QUALITY SYSTEM
CERTIFIED BY DNV
ISO 9001

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Biffi Italia s.r.l.

Headquarters, Sales department, 29017 Fiorenzuola d'Arda - Italy tel. +39 0523 944411 fax +39 0523 943923 e-mail biffi_italia@biffi.it

A tyco INTERNATIONAL LTD. COMPANY

website: www.biffi.it