USER MANUAL

Accessory 72E

UMAC Fieldbus Interface

3x0-603777-xUxx

August 5, 2008

DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ...

Single Source Machine Control *Power // Flexibility // Ease of Use*
21314 Lassen Street Chatsworth, CA 91311 // Tel. (818) 998-2095 Fax. (818) 998-7807 // www.deltatau.com

Copyright Information

To report errors or inconsistencies, call or email:

Delta Tau Data Systems, Inc. Technical Support
Phone: (818) 717-5656
Fax: (818) 998-7807
Email: support@deltatau.com
Website: http://www.deltatau.com

Operating Conditions

All Delta Tau Data Systems, Inc. motion controller products, accessories, and amplifiers contain static sensitive components that can be damaged by incorrect handling. When installing or handling Delta Tau Data Systems, Inc. products, avoid contact with highly insulated materials. Only qualified personnel should be allowed to handle this equipment.

In the case of industrial applications, we expect our products to be protected from hazardous or conductive materials and/or environments that could cause harm to the controller by damaging components or causing electrical shorts. When our products are used in an industrial environment, install them into an industrial electrical cabinet or industrial PC to protect them from excessive or corrosive moisture, abnormal ambient temperatures, and conductive materials. If Delta Tau Data Systems, Inc. products are directly exposed to hazardous or conductive materials and/or environments, we cannot guarantee their operation.

REV	DESCRIPTION	DATE	CHG	APPVD
1	REMOVED “SYCON CONFIGURATION” SECTION	05/21/06	C.PERRY	A. SOTELO
2	CORRECTED E-POINT JUMPER DESCRIPTIONS	05/23/06	C.PERRY	A. SOTELO
3	REMOVED APPENDIX A (SYCON MANUAL), REARRAGED APPENDIX ORDER, CREATED APPENDIX C (HILSCHER HYPERLINKS)	05/23/06	C.PERRY	A. SOTELO
4	UPDATED ID JUMPERS FOR REV 100 AND NEWER REVISIONS. UPDATED PINOUTS FOR REV 100 AND NEWER REVISIONS.	05/26/06	C.PERRY	A. SOTELO
5	UPDATED “DATA HANDSHAKING MODES” SECTION	05/30/06	C.PERRY	A. SOTELO
6	ADDED PDACK AND PDCOM STATES TO “DATA HANDSHAKING MODES” SECTION; UPDATED DESCRIPTIONS IN DPRAM MEMORY MAP	06/13/06	C.PERRY	A. SOTELO
7	ADDED DIAGNOSTIC FLAG DESC. TO PROFIBUS & DEVICENET	06/16/06	C.PERRY	A. SOTELO
8	ADDED DIAGNOSTIC FLAG DESC. TO CANOPEN & CONTROLNET REMOVED APPENDIX A, UPDATED APPENDICES NAMING CONVENTION	06/19/06	C.PERRY	A. SOTELO
9	ADDED SW1 DESCRIPTION	07/06/06	C.PERRY	A. SOTELO
10	ADDED CC-LINK SECTION, APPENDICES B AND C UPDATED UBUS ADDRESSES, P. 5 UPDATED Profibus LED's, page22 UPDATED CC-LINK LED INFO, P. 66	08/05/08	C.PERRY	M. COGUR

Table of Contents

INTRODUCTION

This manual provides the information needed to configure a fieldbus interface for the UMAC. The ACC-72E is equipped with a "gateway" daughter card that allows the UMAC to send and receive data through the supported fieldbus protocol. The gateway used is the COM series, provided by the Hilscher Corporation. Relevant hyperlinks are provided in Appendix C for in-depth information regarding these modules.

There are two connectors located on the front of the ACC-72E. For Profibus, DeviceNET, CANopen and ControlNET options a male DB9 connector is specified as the Diagnostic Connector and provides a RS232 link for the SyCon software. The second connector is referred to as the fieldbus connector as it provides a means to become connected to the fieldbus link. The form factor of this connection is dependent on which fieldbus protocol is being utilized. For the Control & Communication Link (CC-Link) option, the first connector is 10 pin IDC male header which provides a RS232 link for communication with the Compro software. The second connector is the 5 pin Combicon male connector which is the fieldbus link.

The PMAC Gateway 3U supports the following protocols:

- ProfiBus Master-Opt1 (Female DB9)
- ProfiBus Slave-Opt2 (Female DB9)
- DeviceNet Master-Opt3 (5-pin Terminal Block)
- DeviceNet Slave-Opt4 (5-pin Terminal Block)
- CANopen Master-Opt5 (Female DB9)
- CANopen Slave-Opt6 (Female DB9)
- ControlNET Adapter-Opt7 (BNC)
- CC-Link Adapter-Opt11 (5-pin Terminal Block)

The protocol is dependent upon the equipped COM gateway. The hardware cannot be programmed for an alternate protocol including master/slave. However, should the COM gateway be replaced with one supporting another protocol, the baseboard would function properly as a communications link to UMAC although the fieldbus connector might be incorrect for the new fieldbus.

Most gateway cards get their power from the UBUS back plane. However, the DeviceNet version (Options 3 & 4) require an external 24Vdc power supply for the fieldbus.

Configuring the Gateway

There are ten steps in applying the Gateway for ProfiBus, DeviceNET, CANopen and ControlNET. The CC-Link set up is explained in its section:

1. Install the SyCon and PEWIN software on the PC.
2. With the power off, plug the ACC-72E into the UBUS backplane.
3. Connect the diagnostic interface to the serial port on the PC.
4. Launch the SyCon setup utility from the PC.
5. Establish communications to the COM gateway.
6. Configure the fieldbus and download it to the card. (The default configuration can be used for testing.)
7. Assign PMAC M -variables to access the fieldbus bytes at the appropriate Dual Port RAM address.
8. Manually test by setting byte values in PMAC, verifying that they get to the appropriate fieldbus location. Also, check communication from the fieldbus to PMAC.
9. Configure the gateway's fieldbus characteristics via the diagnostic port if required by the application.

10. Implement the assigned M-variables in PLCs or motion programs as required. Appendix A and B provide examples for M-variable assignment and implementation. Appendix C provides hyperlinks to Sycon configuration files for each fieldbus device, provided by Hilscher Corp.

SyCon is provided with the gateway module under license from Hilscher Corp. PEWin32 is a Delta Tau product and normally is purchased with the first PMAC.

THEORY OF OPERATION

The PMAC Gateway 3U board is organized as a motherboard/daughter board system. The motherboard contains the UBUS interface, diagnostics, and the fieldbus connections. The daughter board contains the intelligence and the interface electronics required for each fieldbus. There is a different daughter board for each fieldbus.

A micro controller on the daughter board implements each fieldbus communications protocol. Fieldbus data is transferred to/from the fieldbus and placed in a dual-port ram (memory) on the daughter board. The structure of this DPRAM is given later in this manual and is common for all the field buses supported. There are two different DPRAMs used, a 2K-byte device and an 8K-byte device.

The PMAC side of the DPRAM is interfaced to the UBUS. PMAC programs access the fieldbus data by reading or writing data to memory addresses corresponding to the location of the PMAC Gateway 3U board's DPRAM.

PMAC Gateway Version	DPRAM Size
ProfiBus Master	2k bytes
ProfiBus Slave	2k bytes
ControlNet Adapter	2k bytes
CANopen Master	8k bytes
CANopen Slave	8k bytes
DeviceNet Master	8k bytes
DeviceNet Slave (COM-DNS)	2k bytes
CC-Link Slave (COM-C-CCS)	8k bytes

UBUS Interface

The UBUS is Delta Tau's bus interface for the UMAC controller. The PMAC Gateway 3U maps to the UBUS as a DPRAM style board. It occupies contiguous memory locations (both X and Y memory) of the upper byte, of the 24-bit, DPRAM addresses. Both MEMCS0 and MEMCS1 chip selects are supported.

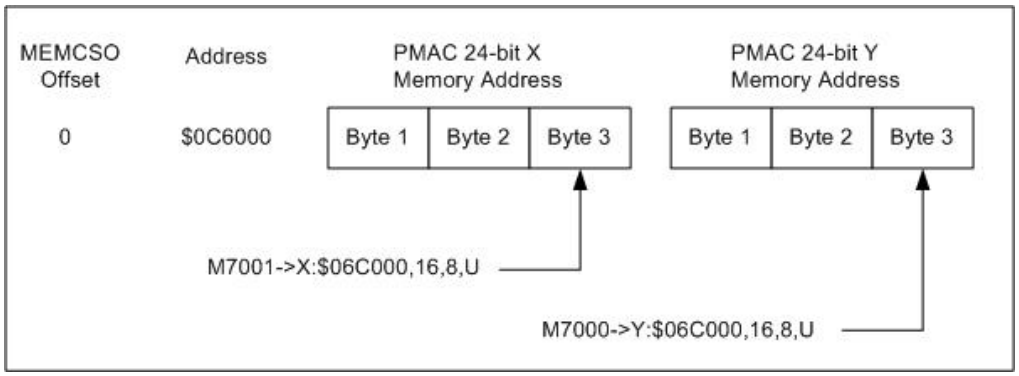
M-variables are mapped to these locations to move data to and from the fieldbus and PMAC. In addition to fieldbus data, a block of memory indicates the PMAC Gateway 3U board's status. Examples of M-variable definitions for each fieldbus are included in this document.

How it Works

1. The PMAC Gateway board organizes fieldbus bytes in a dual-port memory on the gateway module. These fieldbus bytes are mapped into PMAC's memory space via the UBUS interface.
2. PMAC M-Variables are used to move data to and from the fieldbus or to control the gateway board.
3. A switch on the PMAC Gateway board sets the address of the board in PMAC's memory space.
4. The gateway board is configurable via a serial (RS232) port. SyCon is provided with the gateway board for this purpose.
5. Diagnostic LEDs are provided for a visual indication of the board's status.

PMAC Memory

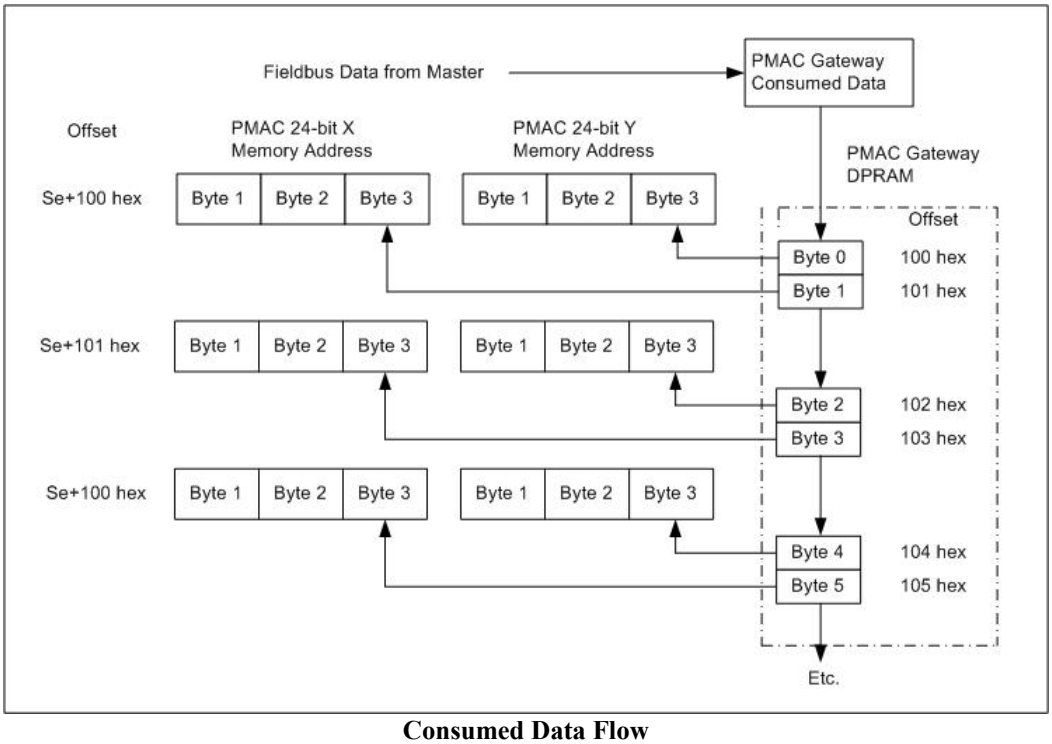
PMAC uses a DSP (Digital Signal Processor) with a 24-Bit architecture that uses two memory areas – Y and X Memory. Memory is accessed in PMAC programs using M-variables. The definition of an M-variable includes its number, address, offset, width and type. Refer to the PMAC Manual for additional explanation of M-variables and their specification.



PMAC Memory Organization

Consumed Process Data Flow

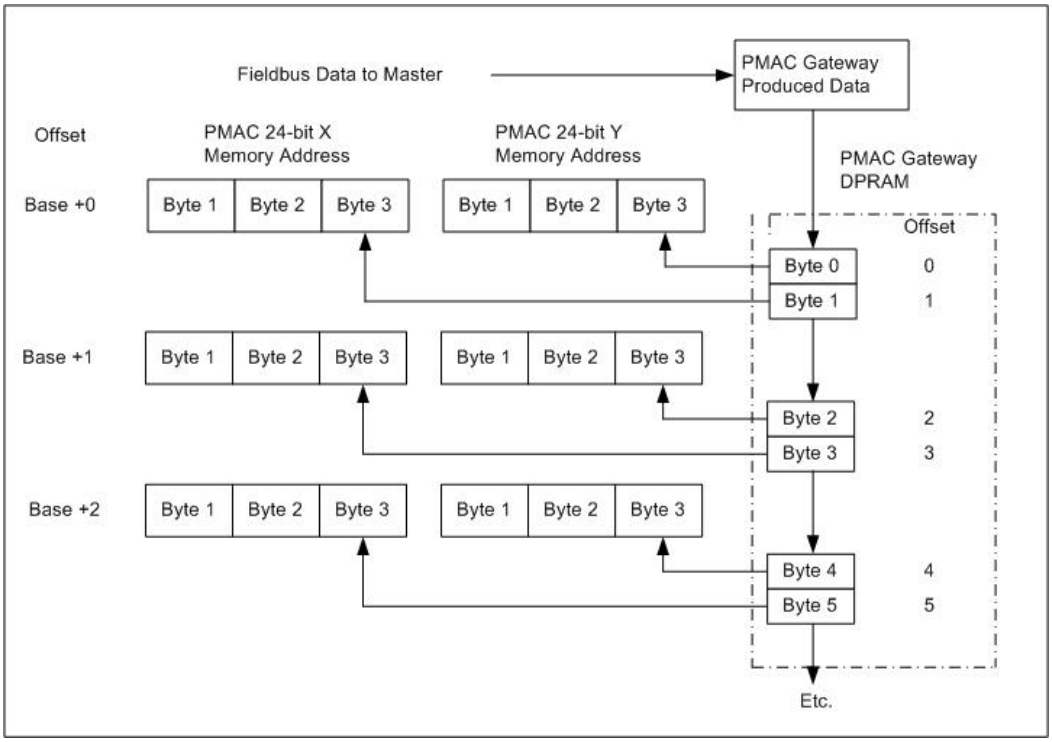
Consumed data (from the gateway's point of view) flows into the DPRAM from the fieldbus and gets mapped to the UBUS as shown in the following diagram. The 100 hex offset shown is for gateway modules with a 2k byte DPRAM.



Consumed Data Flow

Produced Process Data Flow

Produced data (from the gateway's point of view) flows from PMAC to the gateway DPRAM and out to the fieldbus.



Produced Data Flow

UBUS Address

Switch SW1 on the PMAC Gateway controls the address of the PMAC Gateway 3U on the UBUS.

SW1	SW2	SW3	SW4	SW5	SW6	Address Range
ON	ON	ON	ON	ON	ON	Y/X:$6C000 - $6CFFF
ON	OFF	ON	ON	ON	ON	Y/X:$74000 - $74FFF
ON	ON	OFF	ON	ON	ON	Y/X:$6D000 - $6DFFF
ON	OFF	OFF	ON	ON	ON	Y/X:$75000 - $75FFF
ON	ON	ON	OFF	ON	ON	Y/X:$6E000 - $6EFFF
ON	OFF	ON	OFF	ON	ON	Y/X:$76000 - $75FFF
ON	ON	OFF	OFF	ON	ON	Y/X:$6F000 - $6FFFF
ON	OFF	OFF	OFF	ON	**ON**	Y/X:$77000 - $75FFF

The default location is:

SW1	SW2	SW3	SW4	SW5	SW6	Address Range
ON	ON	ON	ON	ON	ON	Y/X:$6C000 - $6CFFF

Note:

Do not set the PMAC Gateway to the DPR address range $6C000-$6CFFF if the UMAC is equipped with Acc-54E. Acc-54E is set to this range as default.

This places fieldbus data beginning at:

Gateway Byte	Turbo PMAC2 Location
0	Y:$6C000,16,8
1	X:$6C000,16,8
2	Y:$6C001,16,8
3	X:$6C001,16,8
4	Y:$6C002,16,8
5	X:$6C002,16,8
6	Y:$6C003,16,8
7	X:$6C003,16,8
Etc.	Etc.

HARDWARE

SW1: DPRAM Address

The following settings for SW1 can be used to configure the base address of the ACC-72E Gateway card.

SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	PMAC DPR Address Range
ON	ON	ON	ON	ON	ON	$6C000-$6CFFF (default)
ON	OFF	ON	ON	ON	ON	$74000-$74FFF
ON	ON	OFF	ON	ON	ON	$6D000-$6DFFF
ON	OFF	OFF	ON	ON	ON	$75000-$75FFF
ON	ON	ON	OFF	ON	ON	$6E000-$6EFFF
ON	OFF	ON	OFF	ON	ON	$76000-$76FFF
ON	ON	OFF	OFF	ON	ON	$6F000-$6FFFF
ON	OFF	OFF	OFF	ON	ON	$77000-$77FFF

CS16\ Identification

The UBUS Specification provides for some plug and play features. Currently, on power up, PMAC tests the valid UBUS base addresses to see if a board is present. One of the techniques used by PMAC is to write patterns to UBUS memory locations and read them back. One reason we mapped the fieldbus bytes to the upper byte of PMAC's memory is that this memory is not written to during PMAC's power up test routines since DPRAM boards are assumed 16-bit not 24-bit boards. If the fieldbus bytes were mapped to the lower bytes, fieldbus outputs could be turned on by the test patterns written to these locations.

Another feature of the UBUS is that memory locations selected by CS16\ (chip select 16...active low) were reserved for board identification information.

- Vendor ID (8 bits)
- Options Present (10 bits)
- Revision Number (4 bits)
- Product ID (14 bits)

This information (36 bits) is accessible directly with I-Variables added in Firmware 1.936 or later. A summary of the PMAC Gateway ID information is in the table below.

I39 controls the values reported.

I39=	I4942…I4952 reports the following
0	36 bits (Vendor ID, Options present, Rev Number, Product ID)
1	8 bits (Vendor ID)
2	10 bits (Options Present) Reported by PMAC in HEX ($)
3	4 bits (Revision Number)
4	14 bits (Product ID)
5	19 bits (Card Base Address)

Identification Information

The Vendor ID is programmed into the PMAC Gateway. The Option Number, Rev Level and Part Number are set by jumpers on the board. The settings below are given for reference only. There is no need to change these from the factory settings. For jumper settings, refer to each individual section.

Revision 100 Jumper Descriptions

Option Jumpers

Item	Description	Part Number	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9
			Bit 9	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15	Bit 16	Bit 17
1	ProfiBus Master	3A1-603777-10x	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	ProfiBus Slave	3A2-603777-10x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3	DeviceNet Master	3A3-603777-10x	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
4	DeviceNet Slave	3A4-603777-10x	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	CANopen Master	3A5-603777-10x	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
6	CANopen Slave	3A6-603777-10x	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
7	ControlNet Slave	3A7-603777-10x	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF

Revision Jumpers

Item	Description	Part Number	JP10	JP11	JP12	JP13
			Bit18	Bit19	Bit20	Bit21
1	ProfiBus Master	3A1-603777-10x	ON	OFF	OFF	OFF
2	ProfiBus Slave	3A2-603777-10x	ON	OFF	OFF	OFF
3	DeviceNet Master	3A3-603777-10x	ON	OFF	OFF	OFF
4	Device Net Slave	3A4-603777-10x	ON	OFF	OFF	OFF
5	CANopen Master	3A5-603777-10x	ON	OFF	OFF	OFF
6	CANopen Slave	3A6-603777-10x	ON	OFF	OFF	OFF
7	ControlNet Slave	3A7-603777-10x	ON	OFF	OFF	OFF

Product ID Jumpers

Item	Description	JP14	JP15	JP16	JP17	JP18	JP19	JP20	JP21	JP22	JP23	JP24	JP25	JP26	JP27
		Bit22	Bit23	Bit24	Bit25	Bit26	Bit27	Bit28	Bit29	Bit30	Bit31	Bit32	Bit33	Bit34	Bit35
1	ProfiBus Master	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
2	ProfiBus Slave	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
3	DeviceNet Master	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
4	DeviceNet Slave	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
5	CANopen Master	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
6	CANopen Slave	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF
7	ControlNet Slave	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON	ON	OFF	OFF

Revision 101 and Later Jumper Descriptions

Option Jumpers

Item	Description	Part Number	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9
			Bit 9	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15	Bit 16	Bit 17
1	ProfiBus Master	3A1-603777-10x	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	ProfiBus Slave	3A2-603777-10x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3	DeviceNet Master	3A3-603777-10x	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
4	DeviceNet Slave	3A4-603777-10x	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	CANopen Master	3A5-603777-10x	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
6	CANopen Slave	3A6-603777-10x	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
7	ControlNet Slave	3A7-603777-10x	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
8	CC-Link Slave	3A11-603777-10x	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF

E-Point Jumper Settings

All Revisions

Point	Default	Description
E1	1-2	1-2 Allows reset of DPRAM by PMAC 2-3 DPRAM reset disabled
E2	ON	ON – Connects gateway module GND to UMAC GND OFF – Separates fieldbus and UMAC GND
E3	OFF	1-2 Connects 1st order filter circuit to fieldbus connector 2-3 Connects 1st order filter circuit to diagnostic connector OFF 1st order filter not used
E4	1-2	Factory Use ONLY
E5	OFF	Connects DPRAM interrupt to UBUS IRQ-1
E6	OFF	Connects DPRAM interrupt to UBUS IRQ-2
E7	OFF	Connects DPRAM interrupt to UBUS IRQ-3

CONNECTOR PINOUTS

Pinouts for Revision 100

Connector TB1 - CANOpen/DeviceNet Options – TB5 Combicon Female

Pin#	Symbol	Function	Description	Notes
1	DGND	-	0V Return line	X5 pin 9
2	CANL	Input/Output	Data Line Low	X5 pin 8
3	SLD	-	Shield of bus cable	X5 pin 10
4	CANH	Input/Output	Data Line High	X5 pin 7
5	+V	Input	+24 external power	X5 pin 3

Connector J3 & J4 – ControlNet Option – BNC Channel A & B

Pin#	Symbol	Function	Description	Notes
1 (signal)	TXD	Input/Output	Data Transmit Line, Channel A	X5 pin 3 (Ch. A) X5 pin 8 (Ch. B)
2 (shield)	TXD-Shield	Input/Output	Cable shield for Data Transmit Line	X5 pin 7 (Ch. A) X5 pin 9 (Ch. B)

Connector P1 – Profibus Options – DB9 Female

Pin#	Symbol	Function	Description	Notes
1	PE	-	Earth Ground	X5 pin 2
2	-	-	-	X5 pin 4
3	RXD/TXD-P	Input/Output	Data line B on PROFIBUS connector [1]	X5 pin 6
4	CNTR-A	Output	Repeater Control Signal	X5 pin 8
5	GND	-	Digital Reference Potential	X5 pin 10
6	VP	-	+5V Reference from UBUS	X5 pin 3
7	-	-	-	X5 pin 5
8	RXD/TXD-N	Input/Output	Data line inverse A on PROFIBUS connector [1]	X5 pin 7
9	-	-	-	X5 pin 9

[1] Note: Designation A and B at the PROFIBUS connector is not equal to the designation A and B of the RS485 driver circuit of most manufacturers. The RXD/TXD-P signal and the RXD/TXD-N signal have a clear meaning.

Connector P2 Sycon Diagnostic – DB9 Male

Pin#	Symbol	Function	Description	Notes
1	-	-	-	X3 pin 2
2	TXD	Output	Transmit data	X3 pin 6
3	RXD	Input	Receive data	X3 pin 4
4	DTR	Output	Data terminal ready, 3.3k Ohm resistor to high level	X3 pin 8
5	GND	-	Fieldbus module Ground	X3 pin 10
6	-	-	-	X3 pin 3
7	RTS	Output	Ready to Send	X3 pin 5
8	CTS	Input	Clear to Send	X3 pin 7
9	-	-	-	X3 pin 9

Revisions 101 and Later Pinout Descriptions

Described below are the alternate pinouts found on Gateway boards with Revisions 101 or later (released 1st quarter of 2006 – Assy. No 603777-101 and later).

Connector J6 Sycon Diagnostic – IDC 10-pin Header

Pin#	Symbol	Function	Description	Notes
1	PE	-	Earth Ground	X3 pin 1
2	-	-	-	X3 pin 2
3	-	-	-	X3 pin 3
4	RXD	Input	Receive data	X3 pin 4
5	RTS	Output	Ready to Send	X3 pin 5
6	TXD	Output	Transmit data	X3 pin 6
7	CTS	Input	Clear to Send	X3 pin 7
8	DTR	Output	Data terminal ready, 3.3k Ohm resistor to high level	X3 pin 8
9	-	-	-	X3 pin 9
10	GND	-	Fieldbus module Ground	X3 pin 10

DPRAM MEMORY MAP

Below is the memory map of relevant addresses found in the DPRAM of the gateway module. See page 3 of this module to determine whether the option ordered on the ACC-72E has a 8KByte cache or a 2KByte cache. In order to read and write to these registers, define an M-variable that points to the upper 8 bits in memory with an offset from the base address that is configured with SW1:

For example, if we were to look at the PMAC Flags on an ACC-72E Option 3 (DeviceNet Master) with a base address of $6D000, we would enter the following into the operator terminal:

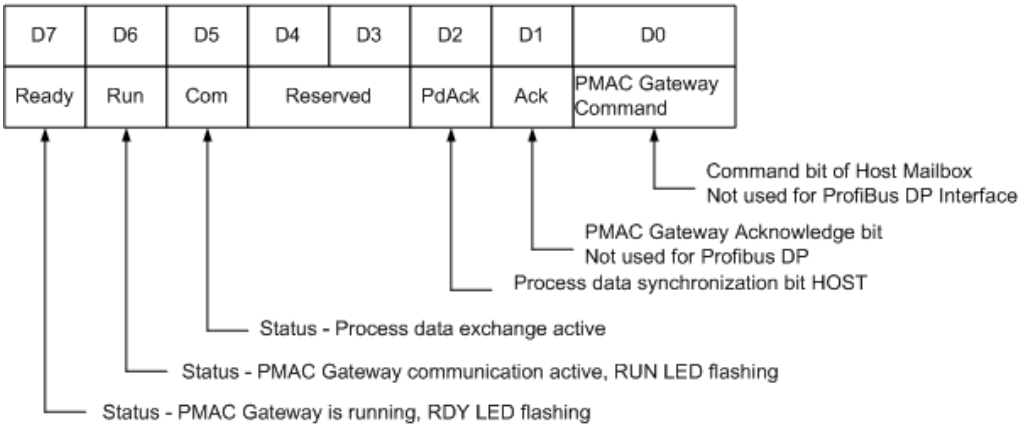
M1->X:$06D00,16,8,U

Offset (8K DPRAM)	**Offset** (2K DPRAM)	**Usage**	**Number of Bytes**	**Comments**
000h-6FFH	000h-0FFh	Send Process Data	512 bytes (2K) 3584 bytes(8K)	Send Process Data
700h-7FFh	100h-1FFh	Received Process Data	512 bytes (2K) 3584 bytes(8K)	Receive Process Data
400h-51Fh	400h-51Fh	Message Buffer	288	PMAC to Fieldbus
E90h-E91h	290h-291h	Date[4]	4 bytes	Gateway module Information
E92h-E93h	292h-293h	DeviceNumber[4]	4 bytes	
E94h-E95h	294h-295h	SerialNumber[4]	4 bytes	
E96h-E97h	296h-297h	Reserved[4]	4 bytes	
E98h-E99h	298h-299h	PcOsName0[4]	4 bytes	Gateway module Information
E9Ah-E9Bh	29Ah-29Bh	PcOsName1[4]	4 bytes	
E9Ch-E9Dh	29Ch-29Dh	PcOsName2[4]	4 bytes	
E9Eh-E9Fh	29Eh-29Fh	OemIdentifier[4]	4 bytes	
540H-065FH	540H-065FH	Message Buffer	288	Fieldbus to PMAC
FF8h	3F8h	RcsVersion	integer	Gateway Operating System Information
FF9h (y)	3F9h (y)	RcsError	byte	
FF9h (x)	3F9h (x)	HostWatchDog	byte	
FFAh (y)	3FAh (y)	DevWatchDog	byte	
FFAh (x)	3FAh (x)	SegmentCount	byte	
FFBh (y)	3FBh (y)	DeviceAddress	byte	
FFBh (x)	3FBh (x)	DriverType	byte	
FFCh (y)	3FCh (y)	DpmSize	Byte	PMAC Gateway Information
			byte	
FFCh (x)	3FCh (x)	DevType	byte	
FFDh-FFEh	3FDh-3FEh	DevModel DevIdentifier[3]	3 bytes	
FFFH (y)	3FFH (y)	Gateway Flags	Byte	CMD and Acknowledge gateway to PMAC Handshake
FFFH (x)	3FFH (x)	PMAC Flags	Byte	CMD and Acknowledge PMAC to gateway Handshake
Note: Message Buffers are not applicable to Master devices.				

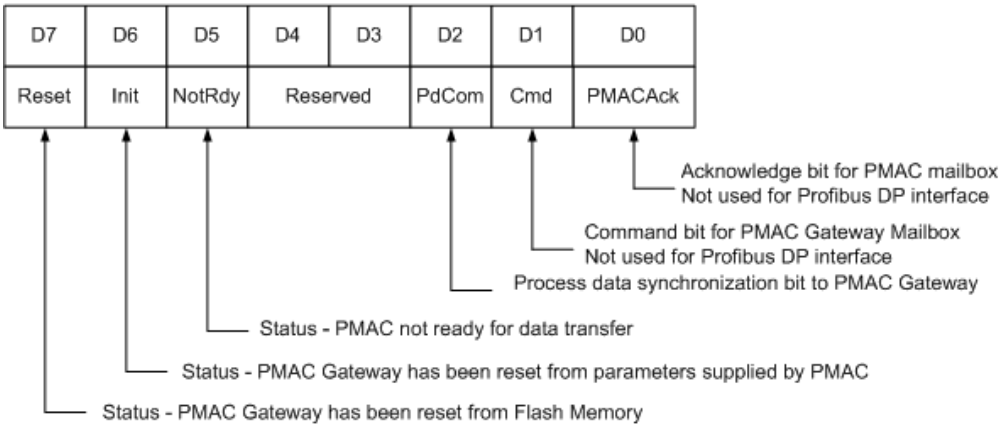
PMAC and Gateway Flags

The handshaking bits for the PMAC and gateway flags reside in the X and Y word, respectively, of the last address in DPRAM memory. "D0" refers to the first bit in the address; since the byte resides in the upper 8 bits of PMAC's addressing scheme, D0 would be equivalent to bit 16, D1 to bit 17, etc. These flags give the user the ability to control the flow of data from the PMAC to the gateway:

PMAC Gateway Flags
PMAC Reads these Bits



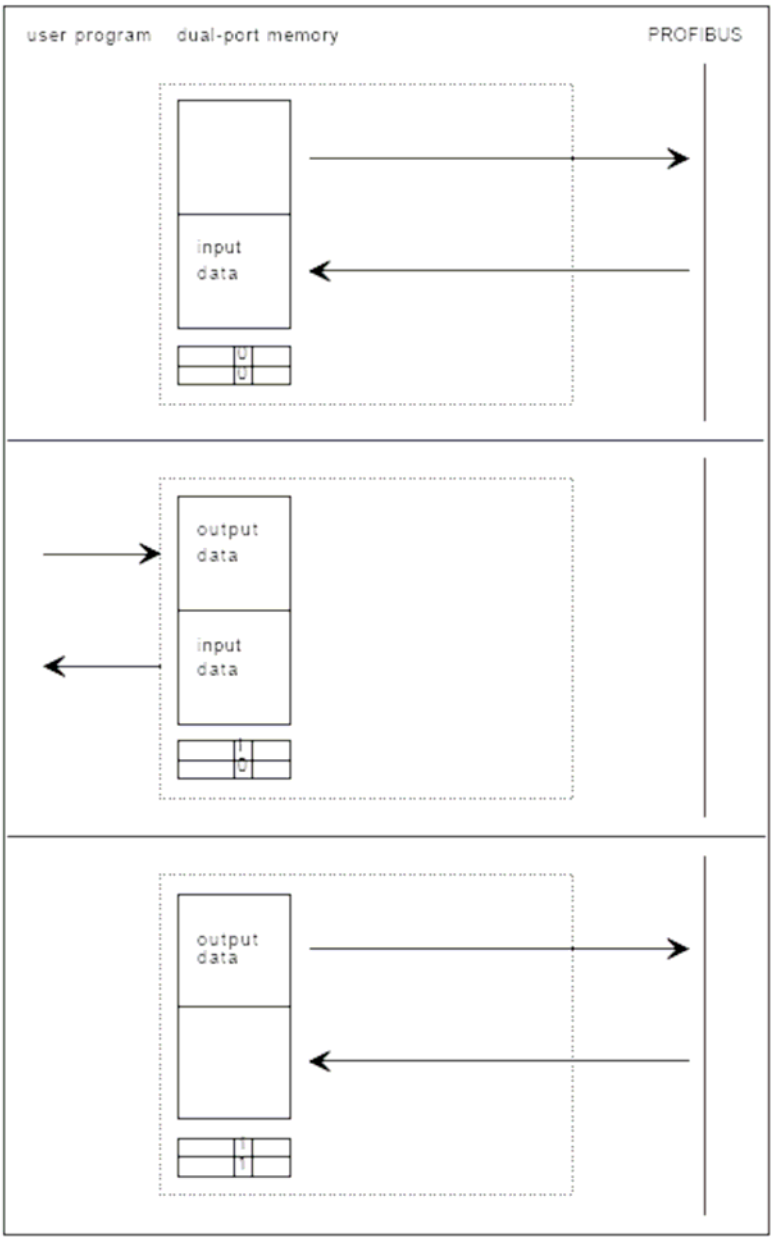
PMAC Flags
PMAC Gateway Reads these Bits



DPRAM DATA PROCESSING

Since there are two processors attempting to access data registers in Dual-Ported Memory (PMAC and the gateway) simultaneously, several handshaking modes can be used to guarantee data consistency. These modes can be selected in Sycon under device settings. Not all modes are supported for every fieldbus protocol. Consult the Sycon manual for each gateway module for handshaking capability. Should handshaking not be necessary, collision circuitry on the gateway will in the very least guarantee consistency within single byte boundaries. For this reason, the default configuration (No Conscience, Uncontrolled) is recommended. Any handshaking is recommended for use only by advanced users that have extensive knowledge of the underlying fieldbus communications protocol.

Bus Synchronous (Direct Transfer), Device Controlled



The gateway automatically starts a data exchange cycle if it is a master, or it receives a data exchange cycle if it is slave. Subsequently it complements the bit `PdAck`.

PdAck	0		1
PdCom	0		0

The PMAC can then read the new input data and write the output data in the dual-port memory. Then PMAC must complement the bit `PdCom`.

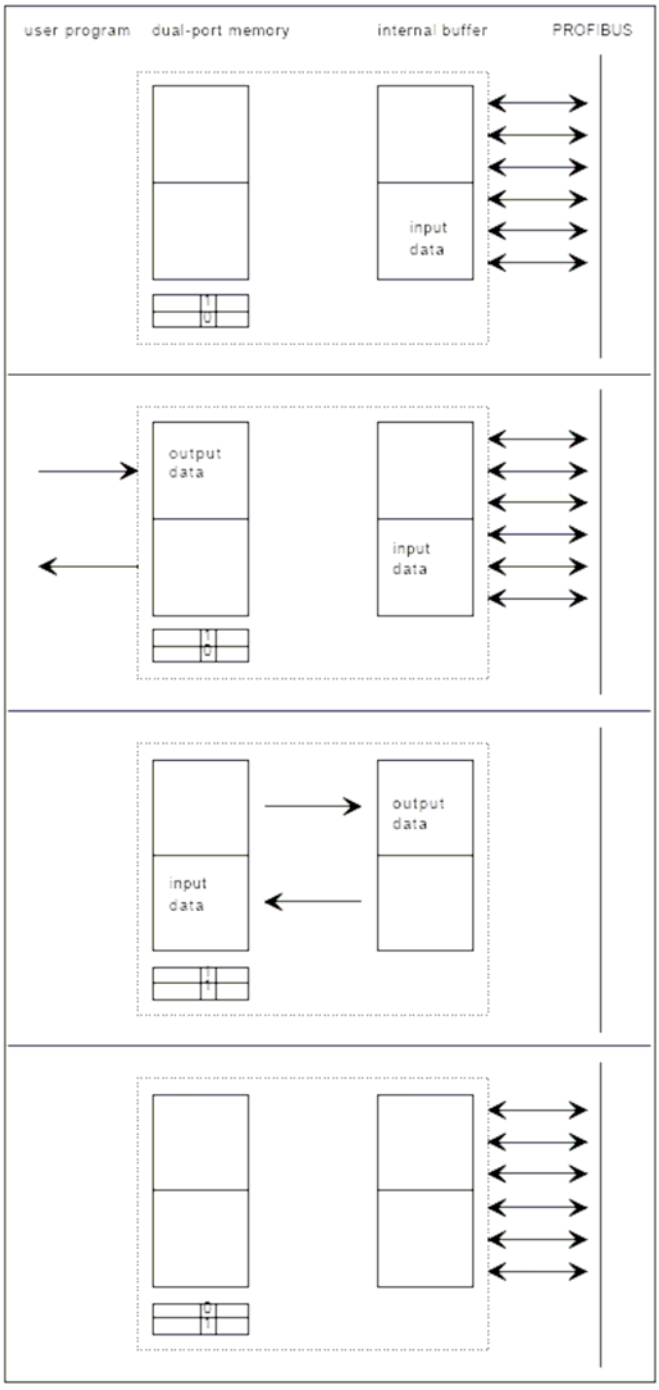
PdAck	1		1
PdCom	0	→	1

The gateway starts the next data exchange cycle.

PdAck	1
PdCom	0

This handshake is used most commonly in a slave system that must guarantee that the data from every fieldbus cycle must be given to the PMAC.

Buffered, Device Controlled



The gateway makes cyclic data exchanges on the bus. After each data exchange the gateway checks if the dual-port memory is available (i.e. `PdCom` is equal to `PdAck`.)

PdAck	1
PdCom	0

If `PdCom` is not equal to `PdAck`, the user program knows that there is new data in the dual-port memory. PMAC can read out the input data and write the new output data. PMAC must then complement `PdCom`.

PdAck	1		1
PdCom	0	→	1

If there was data exchange detected, the gateway exchanges the data between the internal buffer and the dual-port memory. The gateway then complements PdCom

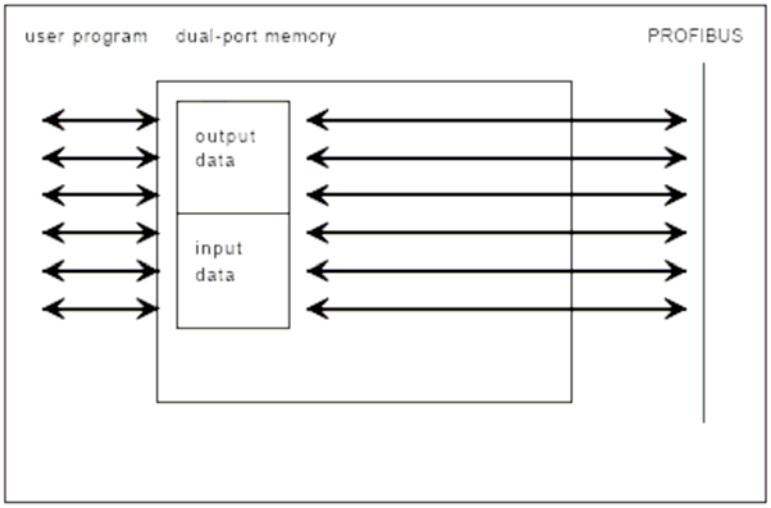
PdAck	1		1
PdCom	1	→	0

The gateway cycles the data exchange again.

PdAck	1
PdCom	0

This handshake is commonly used in slave systems, where the slave gets an interrupt with the next data exchange cycle.

No Conscience, Uncontrolled (Direct Transfer)

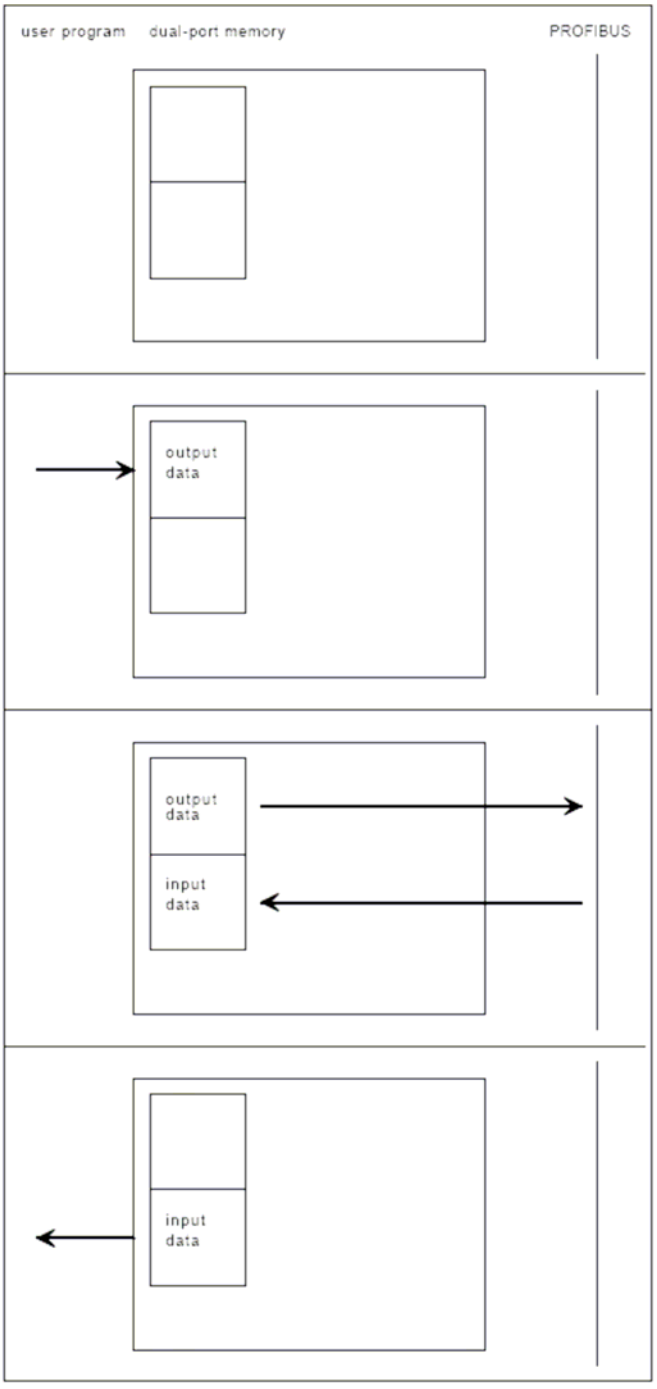


PMAC reads and writes the process image, at the same time as the gateway. The gateway does cyclic data exchanges and after every exchange it makes an update of the process image.

This is the recommended method of data transfer for most users.

This is the most common data transfer for IO devices requiring no handshake.
Attention: If two bytes belong together it is imperative that they are on the same bus cycle otherwise this mode can't be used!

Bus Synchronous (Direct Transfer), Host Controlled



No data exchange.

PdAck	0
PdCom	0

PMAC writes new output data.

PdAck	0
PdCom	0

PMAC must then complement PdCom:

PdAck	0		0
PdCom	0	→	1

Gateway starts one data exchange with the output data from the dual-port memory and writes the new input data in the dual-port memory.

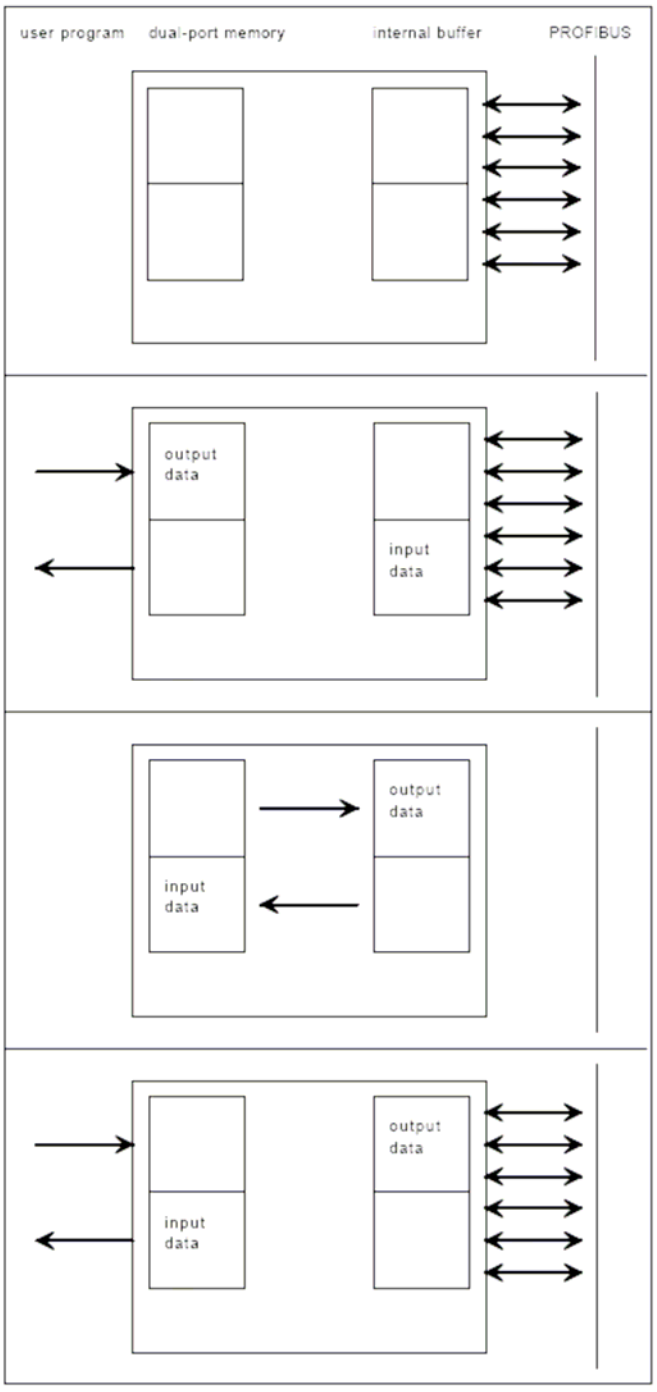
Gateway then complements PdAck after all data is updated:

PdAck	0		1
PdCom	1	→	1

User reads new input data.

This handshake is used most commonly in a master system with synchronous IO devices.

Buffered, Host Controlled



Cyclic data exchange between internal buffer and the gateway occur.

PdAck	0
PdCom	0

PMAC reads last input data and writes new output data. Data exchange with the gateway continues to cycle.

PdAck	0
PdCom	0

PMAC must then complement PdCom:

PdAck	0		0
PdCom	0	→	1

Gateway stops data exchange, puts the output data in its internal buffer and the latest input data in the dual-port memory.

Gateway then complements `PdAck` and starts cyclic data exchange.

PdAck	0		1
PdCom	1	→	1

PMAC then reads input data and writes output data.

This is the easiest handshake in master and slave systems with a guaranteed consistence of the complete process image.

PROFIBUS

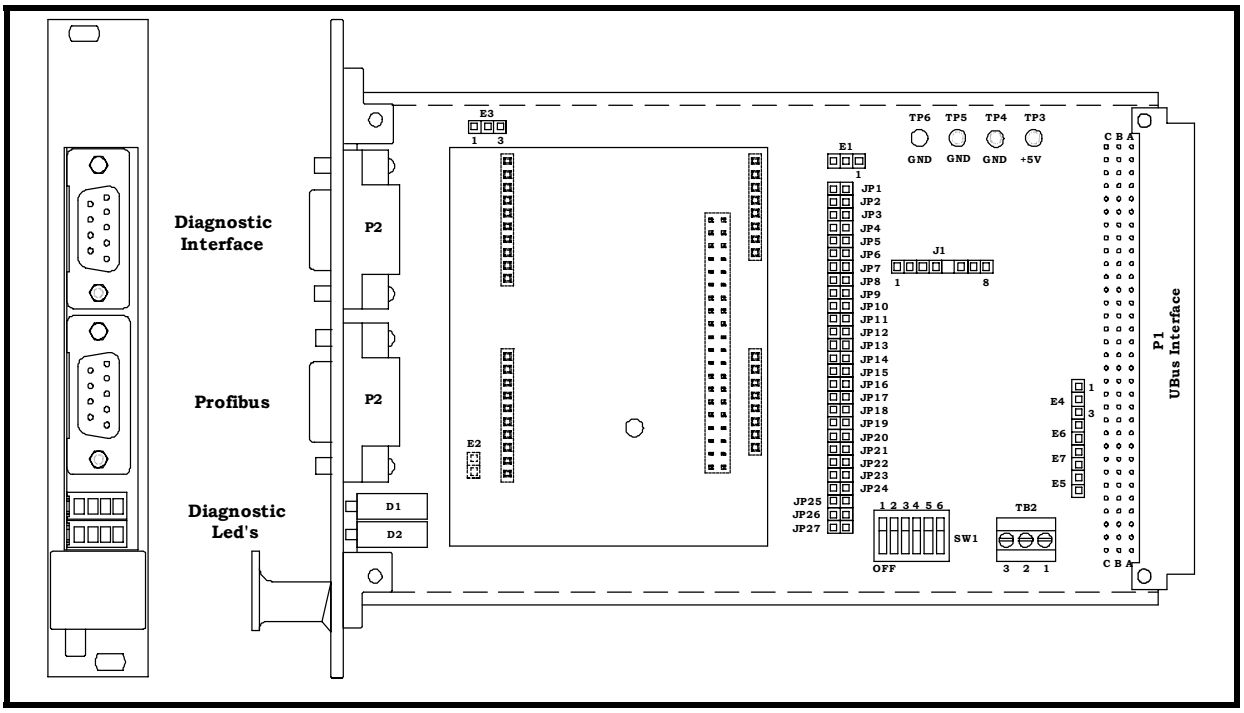
Profibus represents one of the best-known industrial FieldBus protocols from Europe. Profibus can be used in a very wide range of applications as a multi-application communications link for industrial devices, as well as cell-level communication. Profibus is an established standard, first introduced in 1989. The Profibus protocol was originally developed by the committee founded by the German government. The resulting protocol was initially adopted as DIN standard 19245 and was then adopted as a European Common Standard EC50170. Profibus connects to a wide variety of field devices including discrete and analog I/O, drives, robots, MMI products, pneumatic valves, barcode readers, weigh scales, transducers, and flow measuring equipment.

- Profibus utilizes a non-powered two-wire (RS485) network.
- It can transfer a maximum of 244 bytes data per node per cycle.
- Communication rates are selectable but overall end-to-end network distance varies as indicated below:
  - 12Mbps with a maximum distance of 100m
  - 93.75Kbps at maximum distance of 1200m without repeaters

Profibus Specifications

Size	3Ux 4HP (UMAC Compatible)
Power Requirements	+5vdc, 700ma (from UBUS)
Connector Types	96 Pin UBUS interface 9 Pin D-sub Male Diagnostic interface 9 Pin D-Profibus interface
Dual Port Memory Size	2048 Bytes (2K)
Communication Maximum Size	368 Bytes
Inputs	244 Bytes
Outputs	244Bytes
I/O Capacity	1k Bytes
Baud Rate(s)	9.6k up to 12 Mbaud
Max. Nodes	126
Diagnostic RS232C Port	Yes
Program Storage	Flash Memory
Watchdog Timer	Yes
Operating Temperature	0-55Deg C
Profibus Chip Technology	Master = ASPC2 Slave = SPC3
Lab Certified	Yes

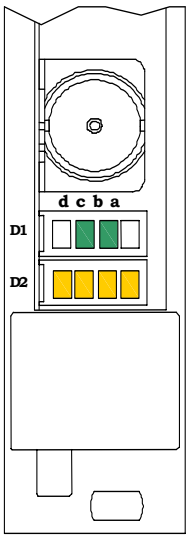
Profibus Layout Diagram



Profibus LEDs

Diagnostic LEDs

Diagnostic LEDs are provided to give visual indications of board status. The green LEDs are easy to understand. If everything is okay, the two inner LEDs will be ON. Other states are discussed below. The yellow LEDs are used to indicate more states than the green ones. Look for patterns as described below to decipher the meaning.



Diagnostic LEDs

Green LED D1-A
Not used on Profibus version

Green LED D1-B
ON = Communication Active
OFF = Communication Stopped
Flashing = Parameter Error (i.e. Mismatch)

Green LED D1-C
ON = Ready
OFF = Hardware Error or no power
Flashing Cyclic = Bootstrap loader active
Flashing Non-Cyclic = System or hardware error

Green LED D1-D
Not used on Profibus version

Yellow LED D2-A
ON = Fieldbus Data Exchange Occurring
OFF = No Fieldbus Data Exchange Occurring

Yellow LED D2-B
ON = Communication Error
OFF = No Communication Error

Yellow LED D2-C
Not used on the Profibus Version

Yellow LED D2-D
Not used on the Profibus Version

Profibus Fieldbus Configuration

The fieldbus side of the PMAC Gateway conforms to the Profibus fieldbus standard. The characteristics of the fieldbus side of the PMAC Gateway are configurable from the configuration port on the PMAC Gateway using the Sycon Configuration software shipped with the PMAC Gateway. The PMAC Gateway slave may be configured from the fieldbus master. The following table summarizes the characteristics that can be configured.

Profibus Master Settings

Item	Parameter	Setting As Shipped
1	Bus speed	1200 K bit/S
2	Handshake mode	No consistence, uncontrolled
3	Behavior after power up	Automatic release of communication by the device
4	Watchdog time	1000 msec
5	Addressing mode	Byte addresses
6	Storage format	Big Endian
7	General	Station address = 0

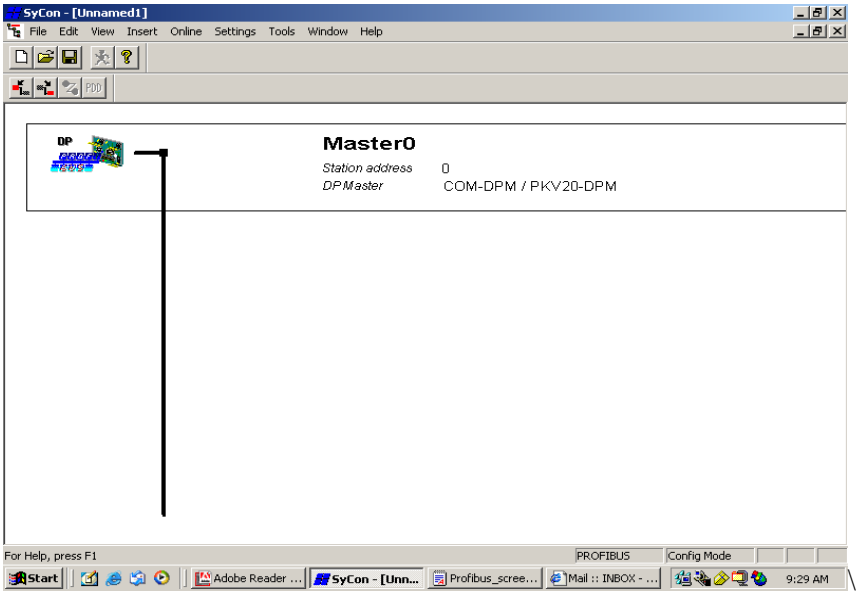
Profibus Slave Settings

Item	Parameter	Setting As Shipped
1	Handshake Mode	No consistence, uncontrolled
2	Configuration Mode	By SyCon
3	Behavior after power up	Automatic release of communication by the device
4	Configuration Data	Standard
5	Watchdog time	1000 msec
6	DPV1 Parameter	Class 2 buffer length = 0
7	General	Station Address = 1
		Activate device in actual configuration
		Enable Watchdog Control
8	I/O Configuration	1
	Length of input data	184 bytes
	Length of output data	184 bytes
	Number of modules	10

The fieldbus characteristics of the PMAC Gateway are defined in GSD files that come with the SyCon software. The Profibus master is defined in HIL 7506.GSD and the Profibus slave is defined in HIL_7501.GSD. The configuration/diagnostic port on PMAC Gateway provides a convenient method for configuration and for monitoring the fieldbus side of the PMAC Gateway. The following provides an example of how to use Sycon and the diagnostic port to configure and monitor the PMAC Gateway.

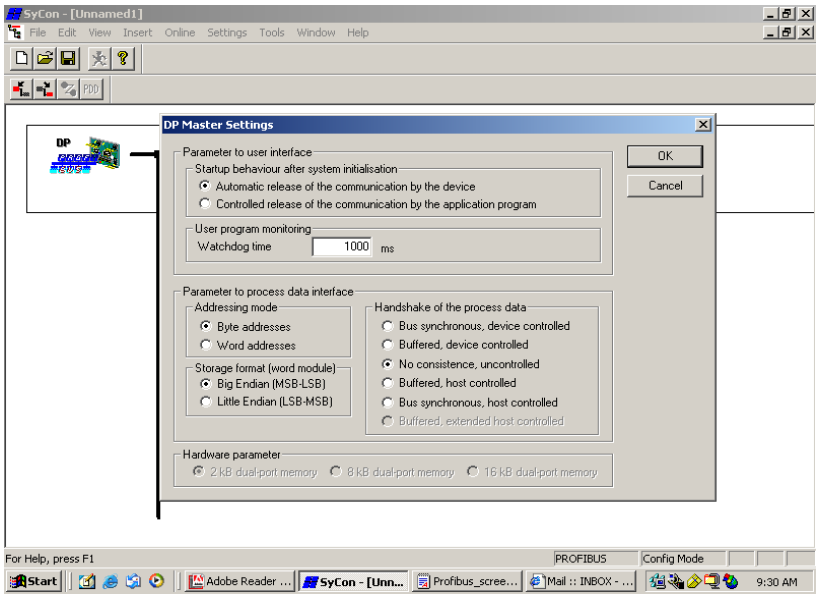
Profibus Sycon Configuration

To insert a new master into the configuration, select the **Master** icon in the menu toolbar and insert a new master on the bus. Once loaded, the screen should be displayed on the PC.

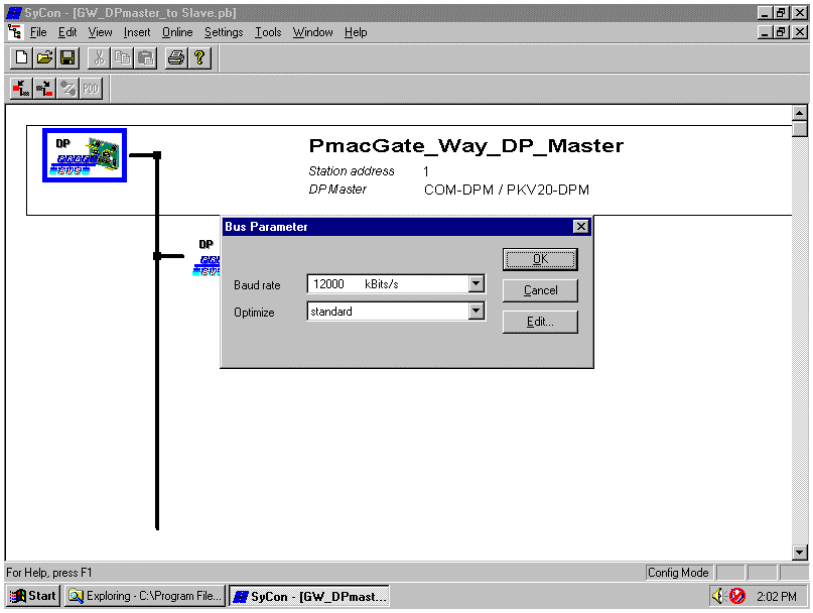


Profibus Master Settings

To enter the master settings, select **Settings – Master Settings** or use the right mouse button at the DP device. The Master settings contain parameters which define the behavior of the PMAC Gateway DPRAM.

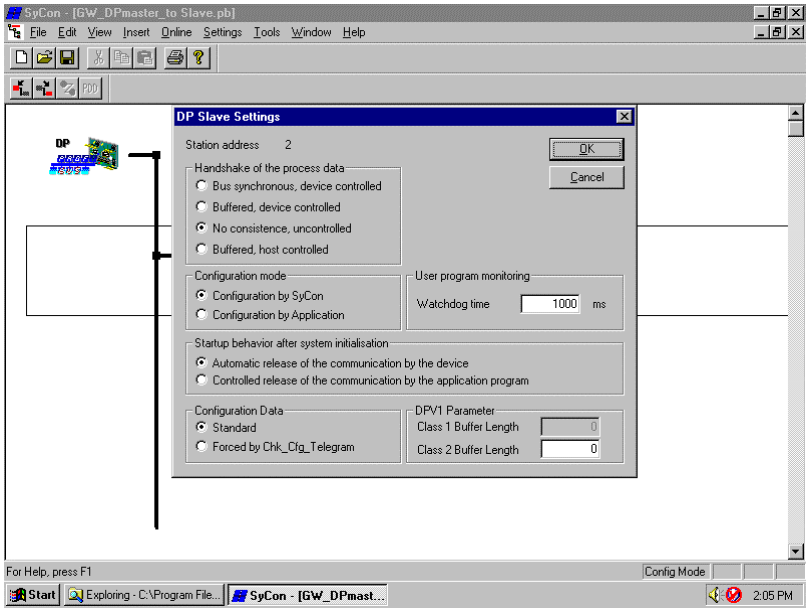


Set the baud rate that the PMAC Gateway should use by selecting the master and selecting **Bus Parameter** under **Settings**. The baud rate is selected from the dialog box shown below:



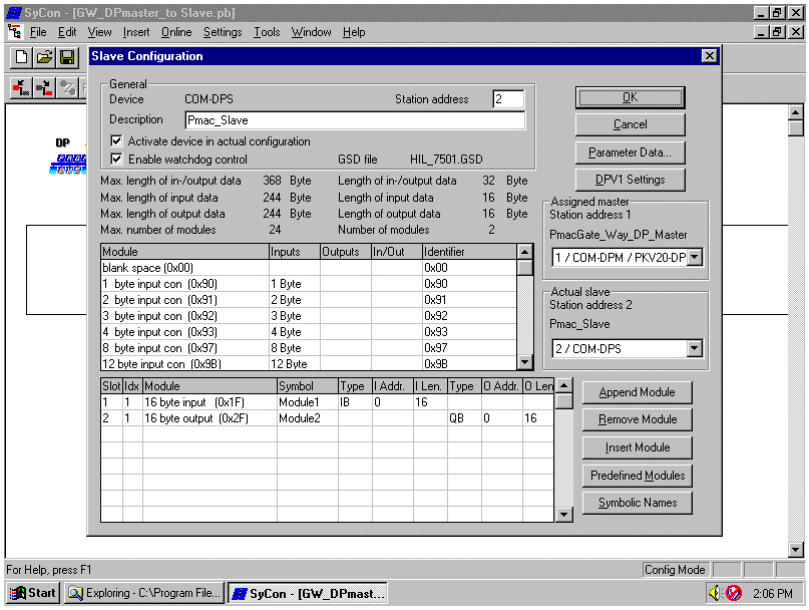
Configuring the Slave for Profibus

Insert a slave onto the bus by using the **Insert Slave** icon in the toolbar menu. Select **DP Slave Settings** from the dialog box. The dialog box below should display. It contains all the communications setting options. The settings shown are the ones set at the time the PMAC Gateway was shipped, and should be sufficient for most applications.



Repeating the process but selecting **Slave Configuration** will result in the screen shown below. The primary purpose of this screen is to define the type of data being communicated to/from the master and the PMAC Gateway. The table in the middle of the screen contains all the possible settings for inputs (Send Process Data) and outputs (Receive Process Data). The lower table displays the current configuration. 184 bytes of input and output were configured when the PMAC Gateway was tested at the factory. This is sufficient for many applications.

If more or less is needed, delete the current setup by selecting the element to change and selecting **Remove Module**. Select the new configuration from the middle table and select **Append Module**.

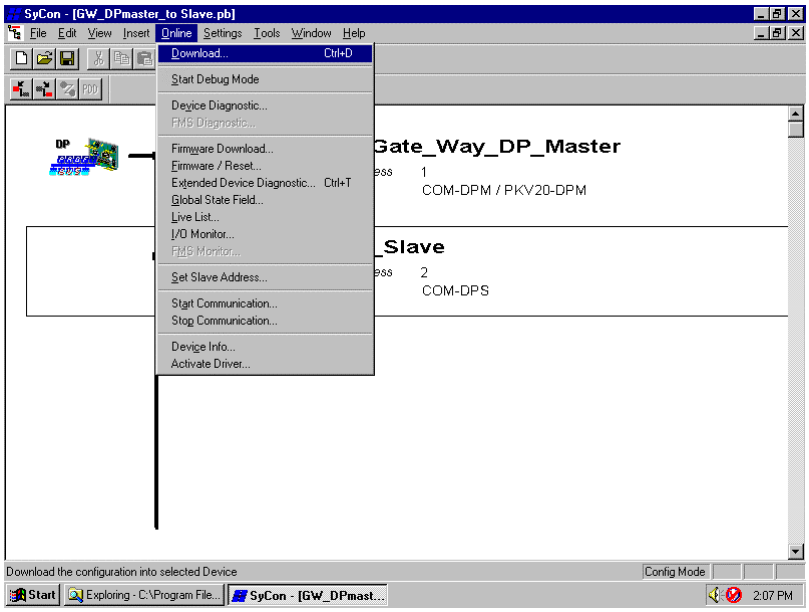


Downloading the Slave Configuration for Profibus

Once the configuration has been completed, it must be downloaded to the PMAC Gateway where it will be saved in flash memory. Downloading also saves the configuration in the PMAC Gateway.

With the slave selected as the actual slave, select the **Online-Download** option in the menu. If communication has not been established, a Driver Select window will appear. Choose **CIF Serial Driver** and establish communication through the COM port.

Repeat the process for the master.



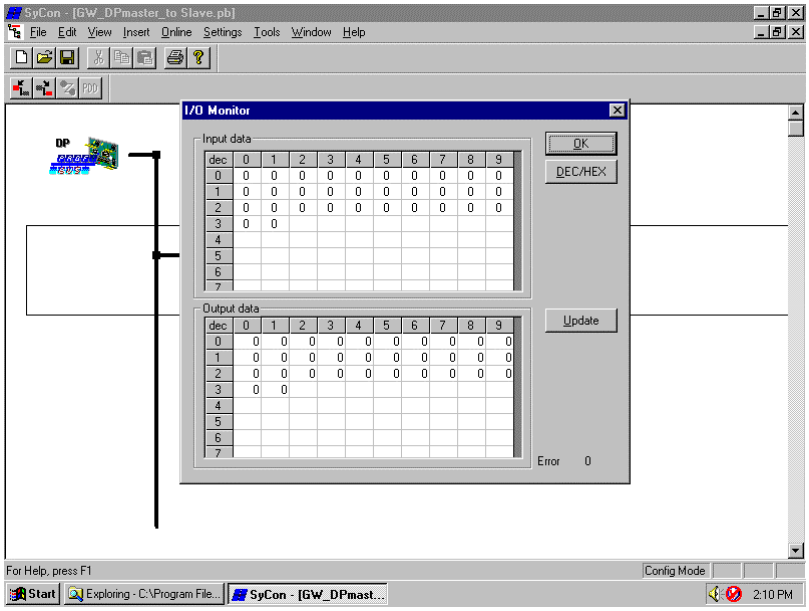
Testing and Monitoring the PMAC Gateway for Profibus

Once the hardware has been configured, test the system to ensure that the fieldbus is working properly and that data sent by the fieldbus Master is received by PMAC and data sent by PMAC is received by the Master. The diagnostic LEDs and the online menu in SyCon are useful tools to determine if the system is working.

The online menu has many useful items. First, explore the I/O monitor function. Once the PMAC Gateway is configured, manually change the Send Process Data and see if the master receives it and monitors the Receive Process Data from the master.

Next, ensure that Send Process Data changed by a PMAC PLC makes it to the master. If writing, downloading and executing a PMAC PLC program similar to the one in Appendix C, and the appropriate bytes change in the PMAC Gateway and in the Master can be seen, the Send Process Data has been checked.

Finally, change data in the Master that becomes Receive Process Data in the PMAC Gateway, and verify that the appropriate M-Variables in PMAC are changed to correctly reflect the values sent by the master.



Monitoring Online Diagnostic Flags from PMAC

Once communications are established to all devices in the fieldbus network, diagnostic flags build into the gateway module can be monitored by PMAC to determine the status of the network during online communications.

Profibus Master Diagnostics

Below are the diagnostic flags that can be found in DPRAM:

Variable	Size	Offset	Description
Global_bits	1 byte	740H	Global error bits
DPM_state	1 byte	741H	Main state of the master system
Err_rem_adr	1 byte	742H	Faulty remote address

- Global bits:

D7	D6	D5	D4	D3	D2	D1	D0
0	TOUT	NRDY	EVE	FAT	NEXC	ACLR	CTRL

CONTROL-ERROR:
parameterization error

AUTO-CLEAR-ERROR:
DEVICE stopped the comm-unication to all slaves and reached the auto-clear end state

NON-EXCHANGE-ERROR
At least one slave has not reached the data exchange state and no process data are exchange with.

FATAL-ERROR:
Because of heavy bus error, no further bus communication is possible

EVENT-ERROR:
The DEVICE has detected bus short circuits. The number of detected events are fixed in the Bus_error_cnt variable. The bit will be set when the first event was detected and will not be deleted any more.

HOST-NOT-READY-NOTIFICATION:
Indicates if the HOST program has set its state to operative or not. If the bit is set the HOST program ist not ready to communicate

TIMEOUT-ERROR:
The DEVICE has detected an overstepped timout supervision time because of rejected PROFIBUS telegramms. It's an indication for bus short circuits while the master interrupts the communication.The number of detected timeouts are fixed in the Time_out_cnt variable.The bit will be set when the first timeout was detected and will not be deleted any more.

reserved

The bit field serves as collective display of global notifications. Notified errors can either occur at the DEVICE itself or at the slaves. To distinguish the different errors the variable `err_rem_adr` contains the error location (bus address). If more than one error is determined, the error location will always show the lowest faulty bus address.

- Variable DPM_state

This variable represents the main state of the master system. Following values are possible:

$00: state OFFLINE
$40: state STOP
$80: state CLEAR
$C0: state OPERATE

- Variable Err_rem_adr

Some bits in the `Global_Bit` field could indicate errors in the network or in the DEVICE itself.. In this case, the variable `Err_rem_adr` represents the source of the error. If the source where the error was detected in the DEVICE itself., then this flag contains the value 255. If the error was detected in another device, the station number (between 0 and 125) will be the value.

Profibus Slave Diagnostics

Below are the diagnostic flags that can be found in DPRAM:

Parameter	Offset	Value	Description
Baud rate (in kBaud)	740h – 741h	12000 6000 3000 1500 500 187 93 9 0	Last detected baud rate 12 MBaud 6 MBaud 3 MBaud 1.5 MBaud 500 kBaud 187.5 kBaud 93,75 kBaud 9600 Baud not detected
Bus Address	742h	1 .. 126	Actual configured bus address.
Ident Number	743h – 744h	7 5 0 1	ID number of gateway module (COM-DPS)
Task State	745h	xxx1 (bit 16) xx1x (bit 17) x1xx (bit 18) 1xxx (bit 19)	Task is initializing. If this state stays for some time, the configuration parameters may be invalid. Task running The initialization happened without error, and a task is running on the bus. Static Diagnosis Slave diagnostic flags are being sent. Data exchange The data exchange mode is active. The user-data will be transferred on the bus between the master and the slave.

DEVICENET

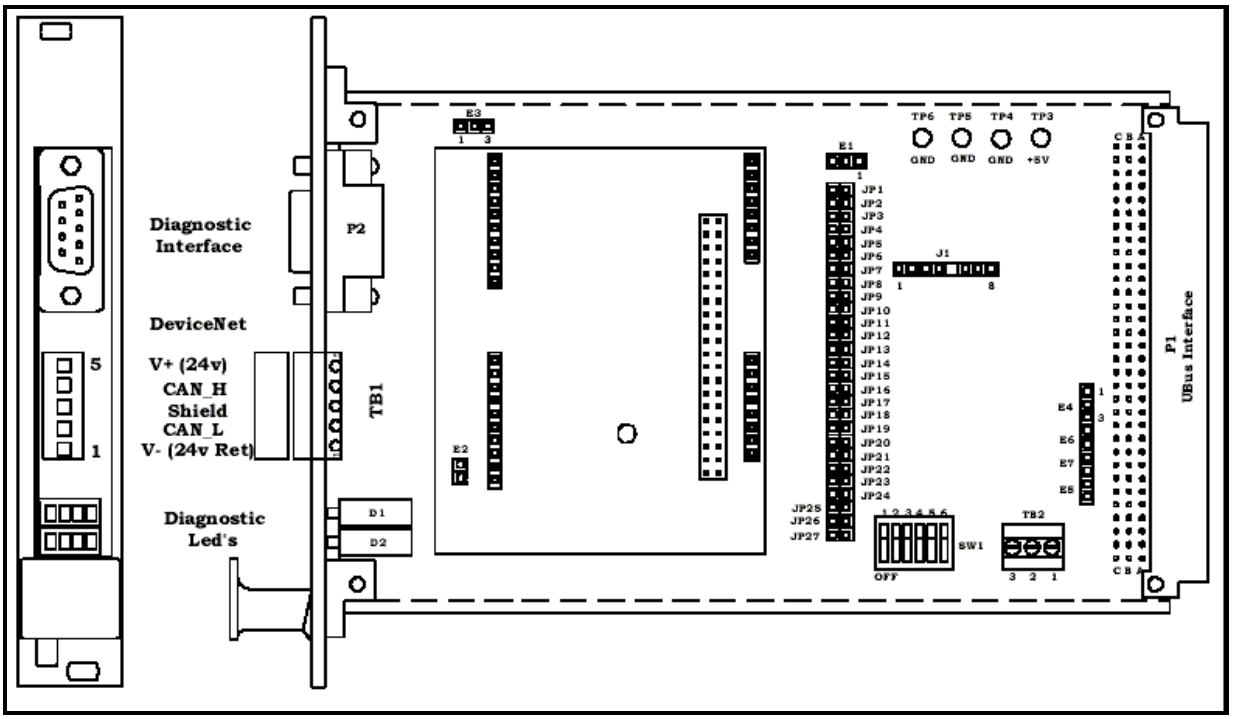
DeviceNet is a low cost communications link that connects industrial devices to a network and eliminates expensive hardwiring. It is based on a broadcast-oriented communications protocol called the Controller Area Network (CAN). The CAN protocol was originally developed by Bosch for the European automotive market for replacing expensive wiring harnesses with low cost network cable on automobiles. The CAN interface and protocol has fast response and high reliability for applications such as controlling anti-lock brakes and airbags.

- DeviceNet utilizes a powered four-wire network.
- It can transfer up to eight bytes of data per node per communication cycle.
- Communication rates are configurable as indicated below:
  - 125 Kbps with maximum distance of 500 meters
  - 250 Kbps with maximum distance of 250 meters
  - 500 Kbps with maximum distance of 100 meters
- Although multiple masters are possible, usually a DeviceNet network consists of one master and many slaves.

DeviceNet Specifications

Size	3Ux 4HP (UMAC compatible)
Power Requirements	+5Vdc, 500ma (UBUS) +24Vdc, 50ma (from external power supply)
Connector Types – Rev 100	96 Pin UBUS interface 9-Pin D-Male Diagnostic interface 5 Position TB connector
Dual Port Memory Size	Slave (COM-DNS) -- 2048 Bytes (2K) Slave (COM-C-DNS) – 8192 Bytes (8K) Master – 8192 Bytes (8K)
Communication Maximum Size	255 Bytes
Inputs	255 Bytes
Outputs	255 Bytes
I/O Capacity	1k Bytes
Baud Rate(s)	125K, 250K, 500K
Maximum Nodes	64
Diagnostic RS232C Port	Yes
Program Storage	Flash Memory
Watchdog Timer	Yes
Operating Temperature	0-55Deg C
Chip Technology	SJA1000
Lab Certified	Yes

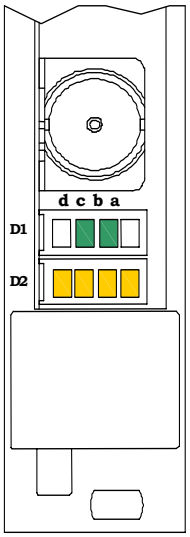
DeviceNet Layout Diagram



DeviceNet LEDs

Diagnostic LEDs

Diagnostic LEDs are provided to give visual indications of board status. The green LEDs are easy to understand. If everything is okay, the two inner LEDs will be ON. Other states are discussed below.



Diagnostic LEDs

Green LED D1-A Not used.

Green LED D1-B
ON = DeviceNet Communication Active
OFF = DeviceNet Communication Stopped
Flashing = DeviceNet Parameter Error (i.e. Mismatch)

Green LED D1-C
ON = Ready
OFF = Hardware Error or no power
Flashing Cyclic = Bootstrap loader active
Flashing Non-Cyclic = System or hardware error

Green LED D1-D Not used

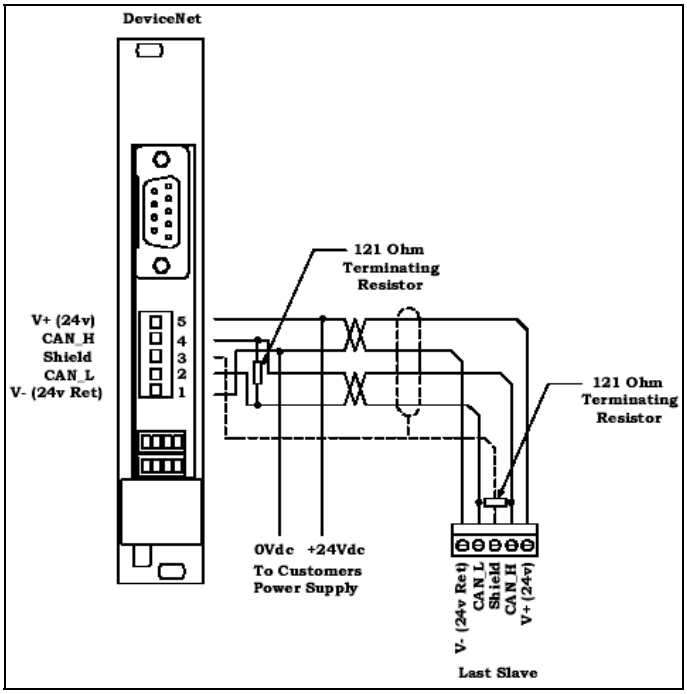
Yellow LED D2-A
ON = Normal no fault
OFF = Fault
Flash = Fault

Yellow LED D2-B
ON = Critical link failure
OFF = Normal
Flash = Connection time out

Yellow LED D2-C
ON = On line link OK
OFF = Device not powered – off line
Flash = Online not connected

Yellow LED D2-D
ON = not applicable
OFF = Normal
Flash = Configuration failure

DeviceNet Typical Interconnection



DeviceNet Fieldbus Configuration

The fieldbus side of the PMAC Gateway conforms to the DeviceNet fieldbus standard. The characteristics of the fieldbus side of the PMAC Gateway are configurable from the configuration port on the PMAC Gateway using the Sycon Configuration software shipped with the PMAC Gateway. The PMAC Gateway slave may be configured from the fieldbus master. The following table summarizes the characteristics that can be configured:

DeviceNet Master Settings

Item	Parameter	Setting As Shipped
1	Bus Speed	500k bit/s
2	Handshake Mode	No consistence, uncontrolled
3	Behavior after power up	Automatic release of communication by the device
4	Watchdog time	1000 msec
5	Addressing Mode	Byte addresses
6	Storage Format	Big Endian
7	General	Mac ID = 0

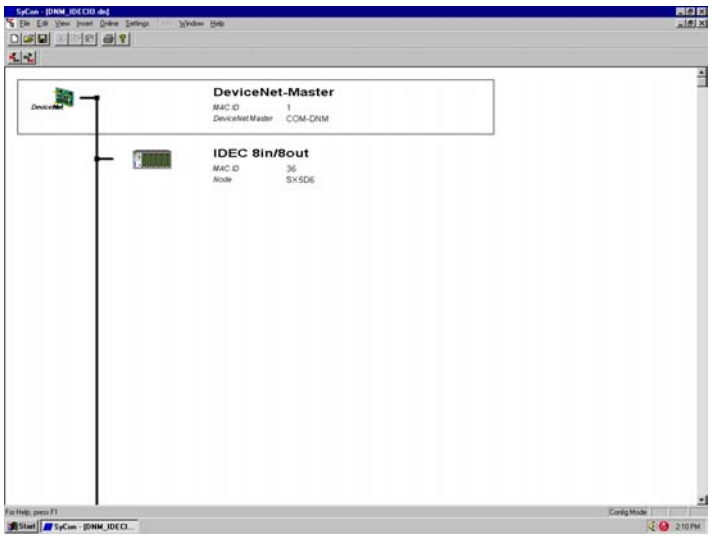
DeviceNet Slave Settings

Item	Parameter	Setting As Shipped
1	Handshake Mode	No consistence, uncontrolled
2	Behavior after power up	Automatic release of communication by the device
3	Watchdog time	1000 msec
4	General	Mac ID = 1 Activate device in actual configuration
5	I/O Connection	Poll
6	I/O Configuration	Input_Data Type IB Ilen=255 Iaddr0 Output_Data Type QB Olen=255 Oaddr=0

The fieldbus characteristics of the PMAC Gateway are defined in EDS files that come with the SyCon software. The DeviceNet master is defined in COMDNM.EDS and the DeviceNet slave is defined in COMDNS.EDS. The configuration/diagnostic port on PMAC Gateway provides a convenient method for configuration and for monitoring the fieldbus side of the PMAC Gateway. The following provides an example of how to use Sycon and the diagnostic port to configure and monitor the PMAC Gateway.

DeviceNet Sycon Configuration

To insert a new master in the configuration, select the **Master** item in the Insert menu or click the icon in the left corner of the screen. In the Insert Master window, add **COM-DNM** to the configuration.

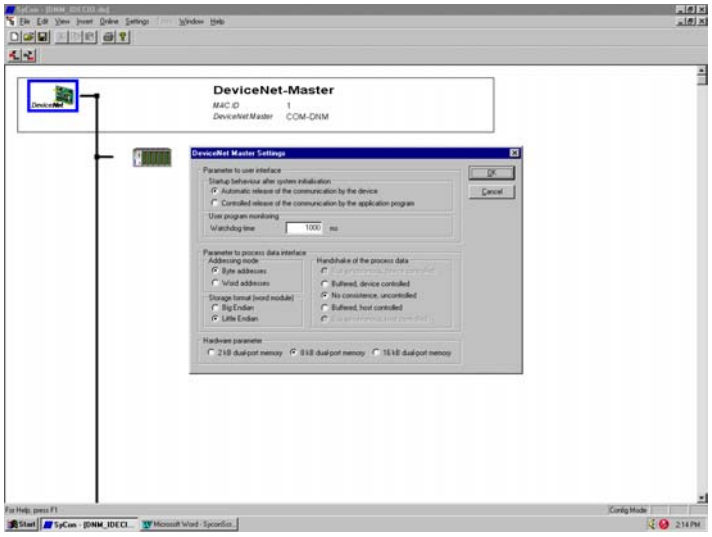


DeviceNet Master Settings

Setup the PMAC Gateway with SyCon using the following settings:

- For DeviceNet Master, use the 8k DPRAM setting (see below).
- To enter the master settings, select the **Settings - Master Settings** menu or use the right mouse button at a DP master device. There is also a **Master Settings** button in the **Master Configuration** window available.

The Master settings contain parameters which defines the behavior of the PMAC Gateway DPRAM.



DeviceNet Insert Slave

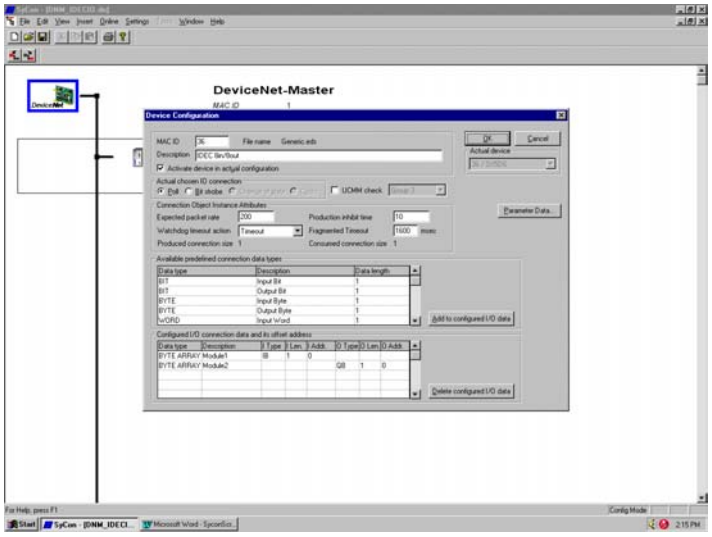
To insert a new slave in the configuration, select the **Slave** item in the menu **Insert**. Click on the position where to insert the new slave. When a dialog box appears, select **COM-DNS**.

In the left list box all slave devices which are presented in the EDS directory are listed. If there are too many, set a filter to select only a special slave family or vendor. When one slave is selected, see additional information about the slave in the list box below. With a double click or with the **Add** button, the slave appears in the right list box. All devices in this box will be connected to the active master who is displayed in the window. If selecting the slaves individually, give every device a name or a short description in the **Description** field.

With the addition of every slave, the MAC ID is incremented, but this valve can be changed manually in the **MAC ID** field.

DeviceNet Slave Configuration

The slave specific configuration is set in this window. Assign the modules and their data to addresses for the process data image in the master device. Remember that these addresses correspond to the application in the PC.



Assign the addresses of the module data in the process image for each module in the lower table. This is set in the columns **Type** and **Addr** for input and output separately.

The I/O address can be entered manually or set automatically by SyCon using the **Auto Addressing** flag, which must be set in the M**aster Settings** window.

Caution:

If Watchdog Control is switched off, it is possible that the slave will not reset slave outputs, even though the communication is broken.

Downloading the Configuration to PMAC Gateway

Use the **Online - Download** menu to download the configuration data to the device.

Before the download happens, SyCon will check the configuration. If any error message appears, the configuration should be checked. Most errors are overlapping addresses which can be located by looking at the **Address Table**. This can be avoided by keeping **Auto Addressing** enabled.

The configuration will be transmitted to the selected device and stored in static Flash memory, so that it is available after the power is switched off and on in this device.

DeviceNet Debugging

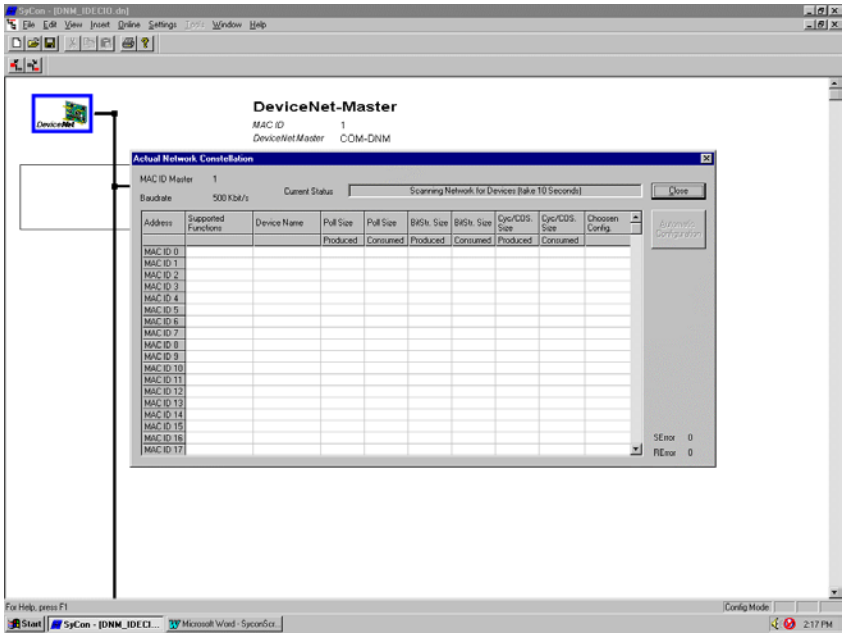
After an actual master has been selected, start the debug mode. From this time, SyCon requests the status of all slaves of the actual master. If there is an error on a slave, the bus line to this slave is drawn in red. Otherwise, it is green. In addition, SyCon displays the **Diagnostic** message if the slave signals diagnostic information. This information is displayed by clicking with the mouse at the corresponding device in debug mode.

To activate the debug mode, select **Online - Start Debug Mode**. The **Online - Device Diagnostic** menu activates the DP slave diagnostic. To end the Debug Mode, select **Online - Stop Debug Mode**.

DeviceNet Auto Network Scan

The current version of Sycon and PMAC Gateway firmware supports automatic network scan. Once the Master is configured, choose **Automatic Network Scan** from the Online pull down menu. The Master (PMAC Gateway) will poll the slave devices from the lowest MACID to the highest. Once the scan is finished, it will display a list of devices that it found. To accept this configuration, select **Automatic Configuration** from the dialog box. Typically, the chosen connection is polling so it should be changed in the **Chosen Configuration. Column** before it is accepted.

Download the new configuration to the master to establish communication. Usually, this is the easiest way to get a network up and running.



Monitoring Online Diagnostic Flags from PMAC

Once communications are established to all devices in the fieldbus network, diagnostic flags build into the gateway module can be monitored by PMAC to determine the status of the network during online communications.

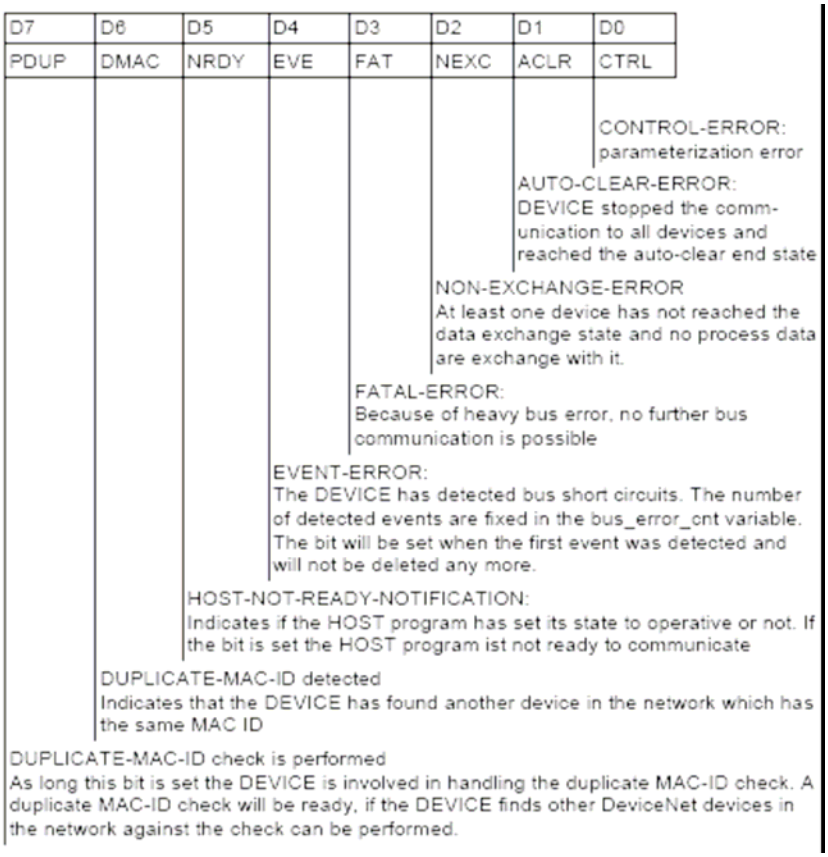
Diagnostic flags are not available for ACC-72E Option 4 (DeviceNet Slave).

DeviceNet Master Diagnostics

Below are the diagnostic flags that can be found in DPRAM:

Variable	Size	Offset	Description
bGlobalBits	1 byte	1F40H	Global error bits
bDNM_State	1 byte	1F41H	Main state of the master system
bErrDevAdr	1 byte	1F42H	Faulty remote address

- bGlobalBits



The bit field serves as collective display of global event indications. Notified errors can either occur at the DEVICE itself or at the handled devices. To distinguish the different errors the variable `Err_dev_adr` contains the error location (address=MAC-ID). If more than one error is determined, the error location will contain the device with lowest MAC-ID.

- Variable `bDNM_State`

This variable represents the main state of the DEVICE system. Following values are possible:

$00: state OFFLINE
$40: state STOP
$80: state CLEAR
$C0: state OPERATE

- Variable `bErrDevAdr`

If either the bits `CTRL`, `ACLR` or `NDATA` are set, this variable is set to the lowest MAC-ID location where the error subsides. If the source of the error is inside the DEVICE itself, the value 255 is written in. For all other instances the faulty device's MAC-ID is written in directly.

CANOPEN

CANopen is a network concept based on the serial bus system Controller Area Network (CAN) and the CAN Application Layer (CAL). Developed originally for passenger cars, the CAN two-wire bus system is already in use in over one million industrial control devices, sensors and actuators. Hallmarks of the internationally standardized bus system (ISO 11898) are its simplicity, high transmission reliability and extremely short reaction times. Many major semiconductor manufacturers sell CAN chips, and the fact that millions of them are used in automobiles guarantees low chip prices and long-term availability. CANopen permits both cyclic and event-controlled communication. This makes it possible to reduce the busload to a minimum and achieve high communication performance at relatively low baud rates.

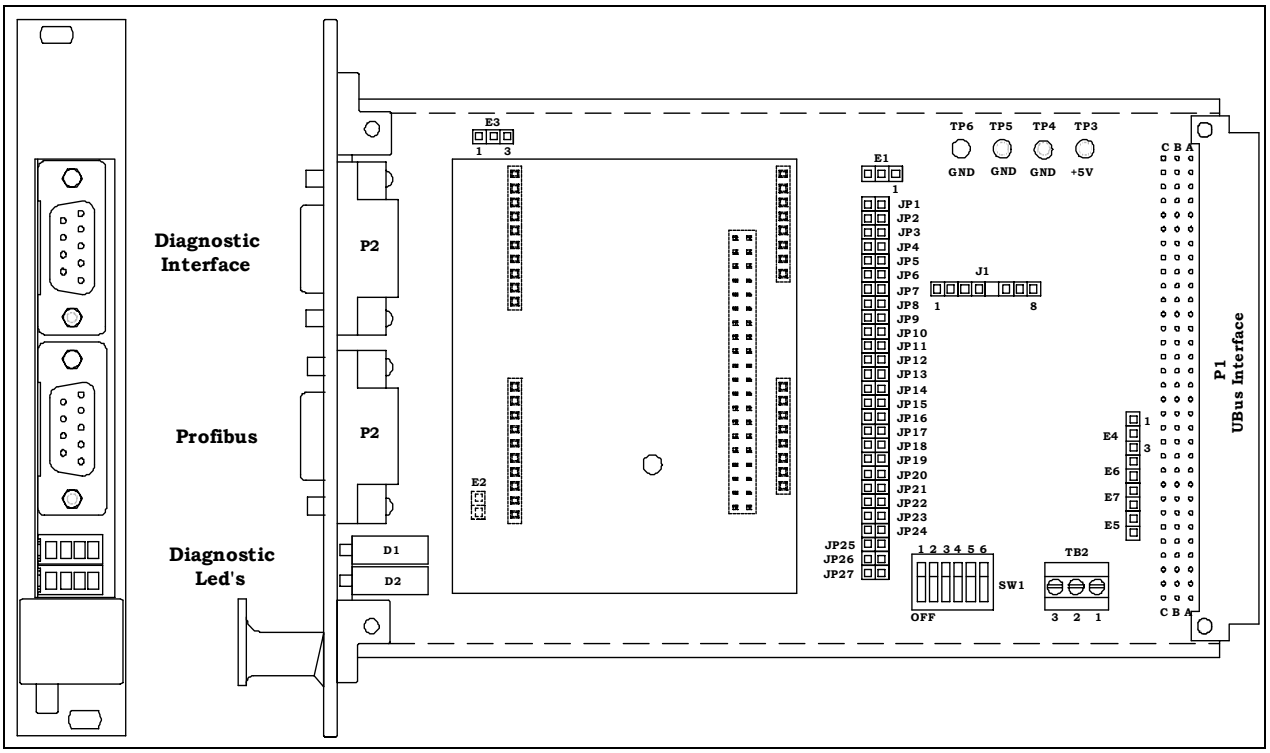
In CANopen, timing behavior can be adapted individually to the particular tasks of the stations involved. This means it is not essential for the entire communication system to have higher performance if it is only required by certain participants. In addition, an automation task may be divided up among several CANopen participants to make optimum use of the power of control devices already in the network, and this can be increased gradually by additional participants.

CANopen allows the creation of inexpensive de-centralized control systems, distributed input/output systems, and networked sensor/actuator systems.

CANopen Specifications

Size	3Ux 4HP (UMAC Compatible)
Power Requirements	+5Vdc, 700ma (from UBUS)
Connector Types	96 pin UBUS Interface 9-Pin D-Male Diagnostic Interface 9-Pin D-CANopen Interface
Dual Port Memory Size	8192 bytes (8k)
Communication Maximum Size	64 bytes
Inputs	32 bytes
Outputs	32 bytes
I/O Capacity	7k bytes
Baud Rate(s)	10k up to 1 Mbaud
Maximum Nodes	125
Diagnostic RS232C Port	Yes
Program Storage	Flash Memory
Watchdog Timer	Yes
Operating Temperature	0-55Deg C
Chip Technology	SJA1000
Lab Certified	Yes

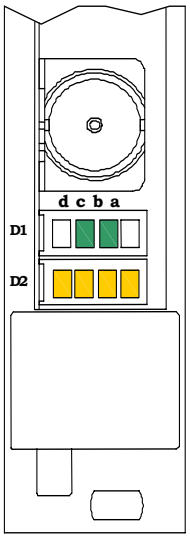
CANopen Layout Diagram



CANopen LEDs

Diagnostic LEDs

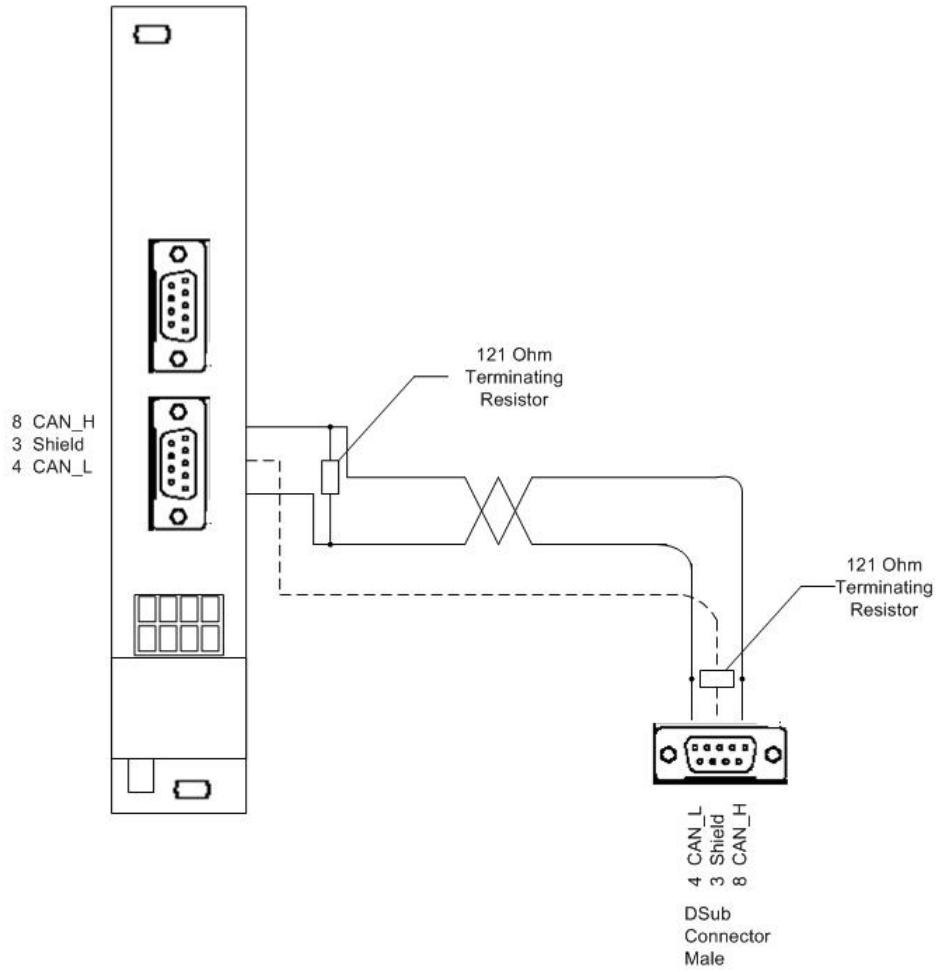
Diagnostic LEDs are provided to give visual indications of board status. The green LEDs are easy to understand. If everything is okay, the two inner LEDs will be ON. Other states are discussed below.



Diagnostic LEDs

Green LED D1-A	Not used.
Green LED D1-B	**ON** = CANOpen Communication Active **OFF** = CANOpen Communication Stopped **Flashing** = CANOpen Parameter Error (i.e. Mismatch)
Green LED D1-C	**ON** = Ready **OFF** = Hardware Error or no power **Flashing Cyclic** = Bootstrap loader active **Flashing Non-Cyclic** = System or hardware error
Green LED D1-D	Not used
Yellow LED D2-A	**OFF** = Off line **Flashing Cyclic** = Online link OK **Flashing Non-Cyclic** = Online not connected
Yellow LED D2-B	**ON** = Critical link failure **OFF** = Normal **Flash** = Connection time out
Yellow LED D2-C	Not used on the CANOpen version
Yellow LED D2-D	Not used on the CANOpen version

CANopen Typical Interconnection



CANopen Fieldbus Configuration

The fieldbus side of the PMAC Gateway conforms to the CANopen fieldbus standard. The characteristics of the fieldbus side of the PMAC Gateway are configurable from the configuration port on the PMAC Gateway using the Sycon Configuration software shipped with the PMAC Gateway. The PMAC Gateway slave may be configured from the fieldbus master. The following tables summarize the characteristics that can be configured:

CANopen Master Settings

Item	Parameter	Setting As Shipped
1	Bus Speed	1M bit/s
2	Handshake Mode	No consistence, uncontrolled
3	Behavior after power up	Automatic release of communication by the device
4	Watchdog time	1000 msec
5	Addressing Mode	Byte addresses
6	Storage Format	Big Endian

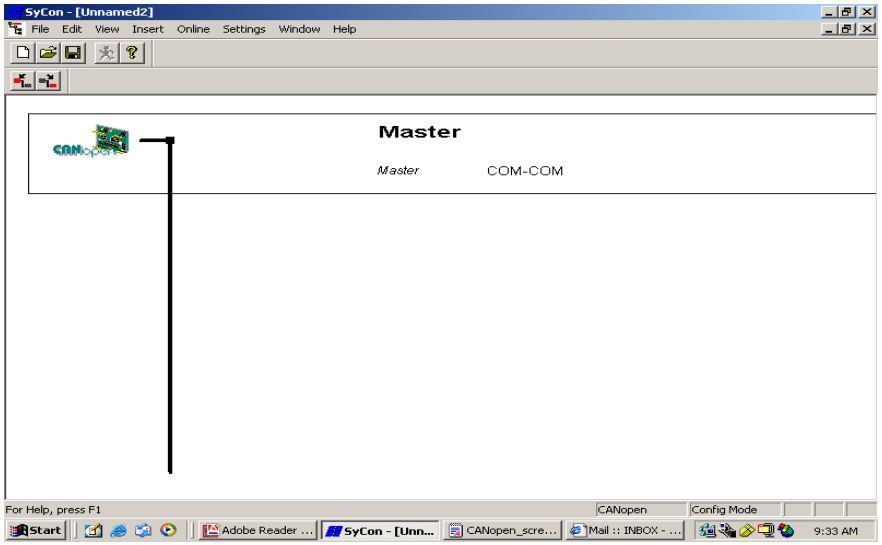
CANopen Slave Settings

Item	Parameter	Setting As Shipped
1	Handshake Mode	No consistence, uncontrolled
2	Configuration Mode	By SyCon
3	Behavior after power up	Automatic release of communication by the device
4	Configuration Data	Standard
5	Watchdog time	1000 msec
6	DPV1 Parameter	Class 2 buffer length = 0
7	General	Node Address = 1
		Activate device in actual configuration
		Automatic COB=1D allocation
8	I/O Configuration	TxPDB1 Type IB Iaddr = 0 Ilen = 8
	(Input Length =32)	TxPDB2 Type IB Iaddr = 8 Ilen = 8
	(Output Length=32)	TxPDB3 Type IB Iaddr = 16 Ilen = 8
		TxPDB4 Type IB Iaddr = 24 Ilen = 8
		RxPD01 Type QB Iaddr = 0 Ilen = 8
		RxPD02 Type QB Iaddr = 8 Ilen = 8
		RxPD03 Type QB Iaddr = 16 Ilen = 8
		RxPD04 Type QB Iaddr = 24 Ilen = 8

The fieldbus characteristics of the PMAC Gateway are defined in EDS files that come with the SyCon software. The CANopen slave is defined in COMCOS.EDS. The configuration/diagnostic port on PMAC Gateway provides a convenient method for configuration and for monitoring the fieldbus side of the PMAC Gateway. The following section provides an example of how to use Sycon and the diagnostic port to configure and monitor the PMAC Gateway.

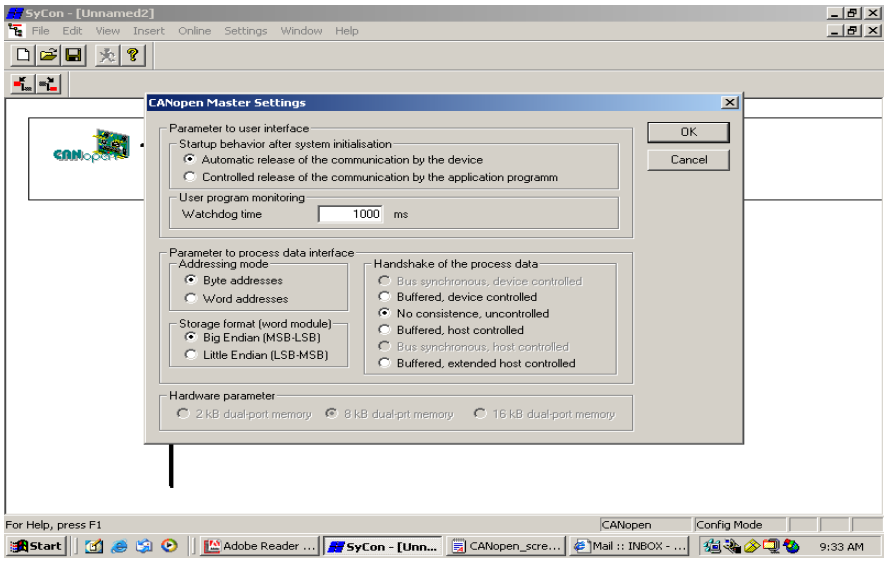
CANopen SyCon Configuration

To insert a new master in the configuration, select the **Master** item in the **Insert** menu or click on the icon in the toolbar menu.



CANopen Master Settings

To enter the master settings, select **Settings - Master Settings** or use the right mouse button at the master device. There is also a **Master Settings** button in the **Master Configuration** window available. The Master settings contain parameters which defines the behavior of the PMAC Gateway DPRAM.



CANopen Insert Slave

To insert a new slave in the configuration, select the **Slave** item in the **Insert** menu. Click on the position where the new slave should be inserted. When a dialog box appears, select one or more slaves.

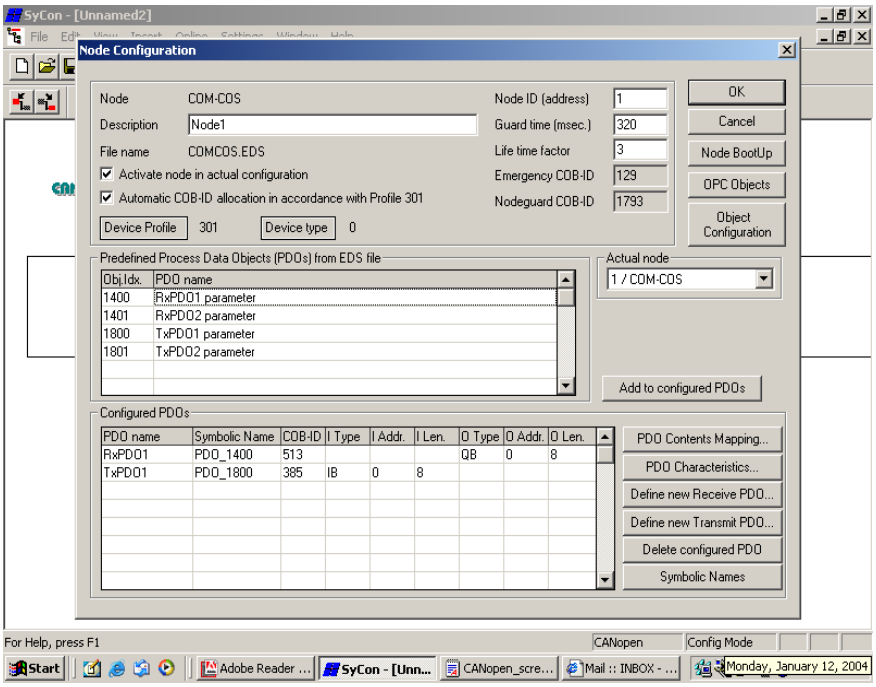
In the left list box, all slave devices are listed which are presented in the EDS directory. If there are too many, set a filter to select only a special slave family or vendor. When one slave is selected, see additional information about the slave in the list box below. With a double click or with the **Add** button, the slave appears in the right list box. All devices in this box will be connected to the active master who is displayed in the window. If selecting the slaves individually, give every device a name or a short description in the **Description** field.

With the addition of every slave, the Node address is incremented, but this value can be changed manually in the **Node ID** field.

Configuring the Slave for CANopen

Select **Slave Settings** from **Settings** or by using the right mouse button. It contains all the communications setting options. The settings are the ones set at the time the PMAC Gateway was shipped and should be sufficient for most applications.

Repeating the process but selecting **Slave Configuration** will result in the screen shown below. The primary purpose of this screen is to define the type of data being communicated to/from the master and the PMAC Gateway. The table in the middle of the screen contains all the possible settings for inputs (Send Process Data) and outputs (Receive Process Data). Change the current setup by selecting the element to change and selecting either **Delete new Receive PDO** or **Delete new Transmit PDO** depending on the parameter selected. Select the new configuration from the middle table and select **Add to configured PDOs**.



Downloading the Configuration for CANopen

The download of the configuration data to the device can be started by selecting **Online - Download**. Before the download happens, SyCon will check the configuration. If an error message appears, the configuration should be checked. The configuration will be transmitted to the selected device and stored in static Flash memory, so that it is available after the power is switched off and on in the device. Repeat the download process for both devices to establish communications.

Monitoring Online Diagnostic Flags from PMAC

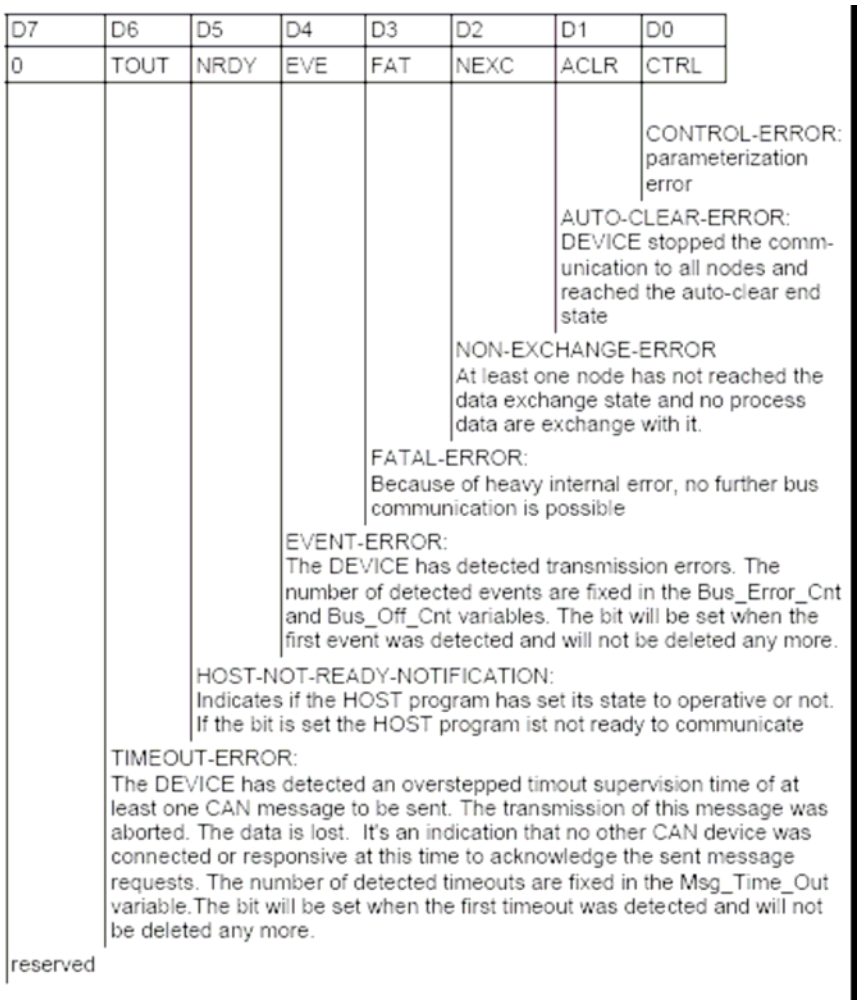
Once communications are established to all devices in the fieldbus network, diagnostic flags build into the gateway module can be monitored by PMAC to determine the status of the network during online communications.

CANOpen Master Diagnostics

Below are the diagnostic flags that can be found in DPRAM:

Variable	Size	Offset	Description
Global_bits	1 byte	1F40H	Global error bits
CAN_State	1 byte	1F41H	Main state of the master system
Err_node_adr	1 byte	1F42H	Faulty node address

- Global_bits



The bit field serves as collective display of global notifications. Notified errors can either occur at the DEVICE itself or at the nodes. To distinguish the different errors the variable `err_node_adr` contains the error location (address). If more than one error is determined, the error location will always show the lowest faulty bus address.

- Variable CAN_state

This variable represents the main state of the master system. Following values are possible:

$00: state OFFLINE
$40: state STOP
$80: state CLEAR
$C0: state OPERATE

- Variable Err_Node_adr

If either the bits `Ctrl, Aclr` or `NData` are set, this variable is set to the lowest node

location of the error. If the source of the error is determined inside the DEVICE itself, the value 255 is written in. For all other instances, the faulty node address is displayed.

CANOpen Slave Diagnostics

Variable	Size	Offset	Description
bNmtState	1 byte	1F40H	Node Management State
bBusEnable	1 byte	1F41H	Bus communication is enabled/disabled
usBusEventCnt	2 byte	1F42H	Bus event counter
usBusOffCnt	2 byte	1F44H	Bus off event counter

- bNmtState

Identifier	Value	Baud Rate
COS_USR_NMT_ST_INIT	0	Init - device is initializing
COS_USR_NMT_ST_PRE_OPERATIONAL	1	Pre-Operational - configuration phase
COS_USR_NMT_ST_PREPARED	2	Prepared - special operation mode
COS_USR_NMT_ST_OPERATIONAL	3	Operational - normal operation

- `bBusEnable`

`1` bus communication is enabled
`0` bus communication is disabled

- `usBusEventCnt`

This variable holds a counter for bus events detected by the CAN chip. It includes warnings, bus off situations and receive queue overruns.

- `usBusOffCnt`

Bus off events indicate severe communication problems on the CAN bus. When the CAN chip detects such a situation it goes to disabled state and is not involved in bus operations anymore. To get it operative again it must be re-initialized which is done by the firmware automatically.

CONTROLNET

ControlNet is a real-time, control-layer network providing high-speed transport of both time-critical I/O data and messaging data, including upload/download of programming and configuration data and peer-to-peer messaging, on a single physical media link. ControlNet's high-speed (five Mbits/sec) control and data capabilities enhance I/O performance and peer-to-peer communications.

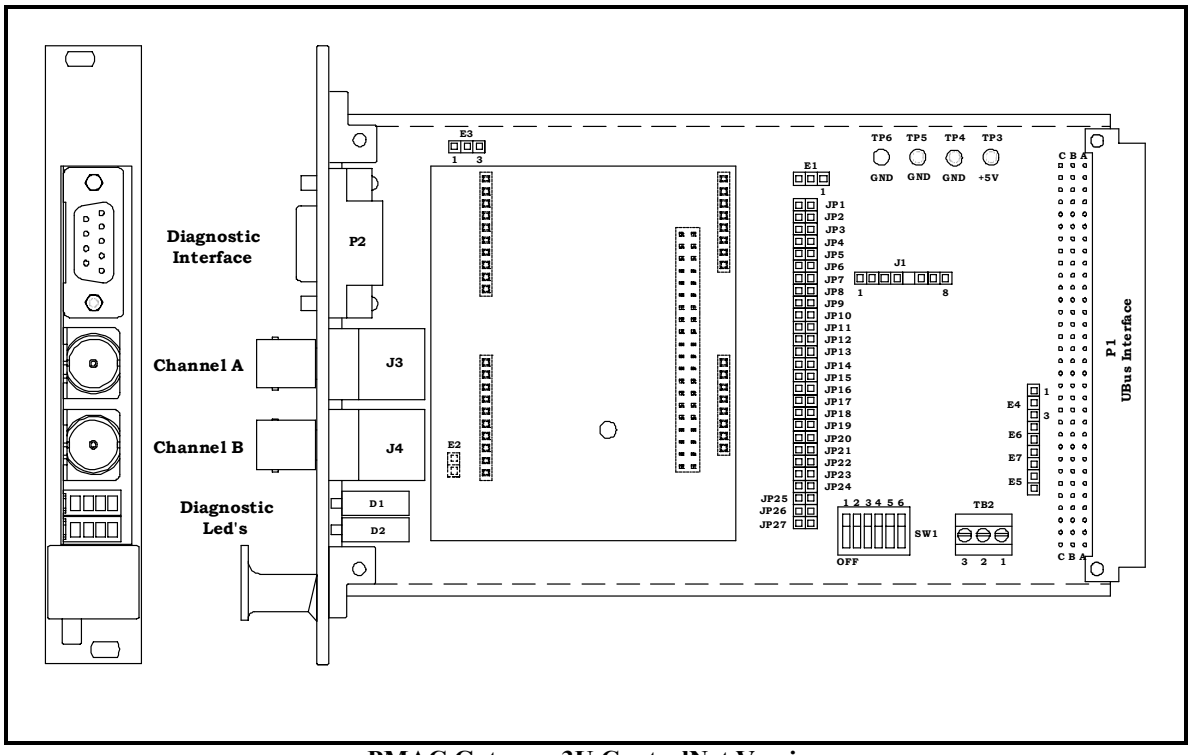
The distance of a segment depends on the number of nodes, respectively on the number of taps. There is no minimum length requirement. The maximum allowable total length of a segment is 1000 m with two taps connected. Each additional tap decreases the maximum length of a segment by 16.3 m. From this it follows the number of taps allowed on a segment (48 with a maximum length of 250 m). Install a repeater if the system requires more than 48 taps per segment, or a longer segment becomes essential. For each segment of the ControlNet system, 75 Ohm terminators are needed.

ControlNet allows multiple controllers to control I/O on the same wire. This provides an advantage over other networks, which only allow one master controller on the wire. In addition, ControlNet allows multicast of both inputs and peer-to-peer data, thus reducing traffic on the wire and increasing system performance.

ControlNet Specifications

Size	3Ux 4HP (UMAC Compatible)
Power Requirements	+5vdc, 700ma (UBUS)
Connector Types	50 Pin JEXP (Expansion Port) interface 9 Pin D-Male Diagnostic interface BNC (ControlNET Channel A) BNC (ControlNET Channel B)
Dual Port Memory Size	2048 Bytes (2K)
Process Data Maximum Size	
Inputs	510 Bytes
Outputs	510 Bytes
I/O Capacity	1020 Bytes
Baud Rate(s)	5 Mbaud
Maximum Nodes	99
Diagnostic RS232C Port	Yes, on standard board No, on NAP version
Program Storage	Flash Memory
Watchdog Timer	Yes
Operating Temperature	0-55Deg C
ControlNet Chip Technology	Rockwell CNA 10
Network Access Port	No on standard board Yes on NAP version
Lab Certified	Yes

ControlNet Layout Diagram

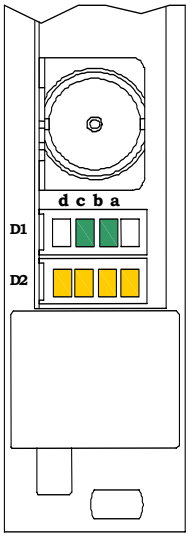


PMAC Gateway 3U ControlNet Version

ControlNet LEDs

Diagnostic LEDs

Diagnostic LEDs are provided to give visual indications of board status. The green LEDs are easy to understand. If everything is okay, the two inner LEDs will be ON. Other states are discussed below.



Diagnostic LEDs

Green LED D1-A Not used on the ControlNet Version

Green LED D1-B
ON = ControlNet Communication Active
OFF = ControlNet Communication Stopped
Flashing = ControlNet Parameter Error (i.e. Mismatch)

Green LED D1-C
ON = Ready
OFF = Hardware Error or no power
Flashing Cyclic = Bootstrap loader active
Flashing Non-Cyclic = System or hardware error

Green LED D1-D Not used on the ControlNet Version

The yellow LEDs operate in pairs. The following pairs are used:

- D2-A, B, C, D can operate together to indicate global of Network faults
- D2-A and D2-D can operate in pairs to indicate conditions of Channel B
- D2-B and D2-C can operate in pairs to indicate conditions of Channel B

Global (Network) Fault Indications

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	OFF	OFF	ON	ON	Self Test alternates between pattern 1 and 2
2	ON	ON	OFF	OFF	

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	ON	OFF	ON	ON	Bad Node alternates between pattern 1 and 2
2	ON	ON	ON	OFF	

Channel Fault Indications (Non-Flashing Patterns)

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	x	OFF	ON	x	Channel A hardware Failure
2	x	ON	OFF	x	Channel A OK
3	x	ON	ON	x	Channel A Disabled
4	ON	x	x	OFF	Channel B hardware Failure
5	OFF	x	x	ON	Channel B OK
6	ON	x	x	ON	Channel B Disabled

Channel Fault Indications (Flashing Patterns)

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	x	OFF	ON	x	Channel A Bad Network Connection
2	x	ON	OFF	x	Alternates between pattern 1 and 2

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	ON	x	x	OFF	Channel B Bad Network Connection
2	OFF	x	x	ON	Alternates between pattern 1 and 2

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	x	OFF	ON	x	Channel A Cable Fault
2	x	ON	ON	x	Alternates between pattern 1 and 2

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	ON	x	x	OFF	Channel B Cable Fault
2	ON	x	x	ON	Alternates between pattern 1 and 2

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	x	ON	OFF	x	Channel A Temporary Network Error
2	x	ON	ON	x	Alternates between pattern 1 and 2

Pattern	D2-D	D2-C	D2-B	D2-A	Meaning
1	OFF	x	x	ON	Channel B Temporary Network Error
2	ON	x	x	ON	Alternates between pattern 1 and 2

ControlNet Settings

The fieldbus side of the PMAC Gateway conforms to the ControlNet fieldbus standard. The characteristics of the fieldbus side of the PMAC Gateway are configurable from the configuration port on the PMAC Gateway using the Sycon Configuration software shipped with the PMAC Gateway. The following tables summarize the characteristics that can be configured:

Device Settings

Item	Parameter	Setting as Shipped
1	Handshake Mode	No consistence, uncontrolled
2	Behavior after power up	Automatic release of communication by the device
3	Watchdog time	1000 msec
4	Addressing Mode	Byte addresses
5	Storage Format	Little Endian
6	General	Mac ID = 3

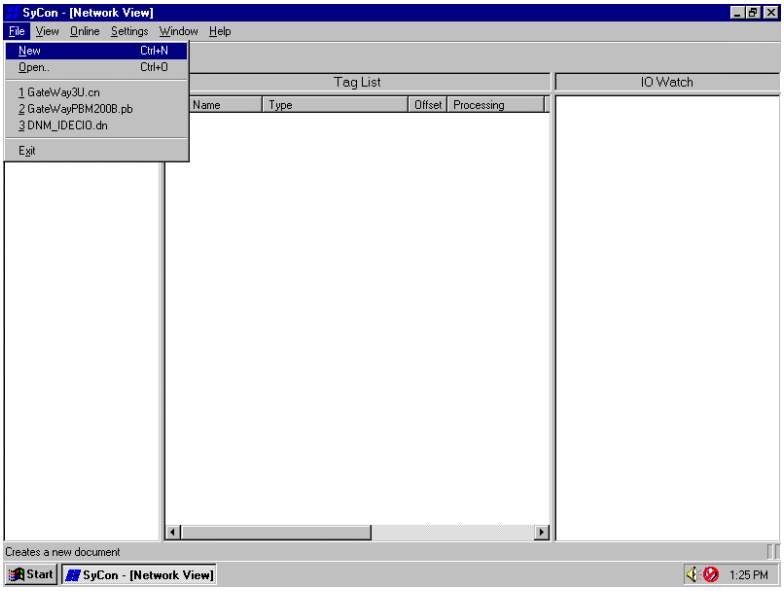
Data Settings

Parameter	Setting as Shipped	Range
Number of input words	215	434 words total (inputs + ouputs)
Number of output words	215	
Unscheduled Services		
Length of file 3	0	0-1000 words
Length of file 4	0	0-1000 words
Length of file 5	0	0-1000 words
Length of file 6	0	0-1000 words

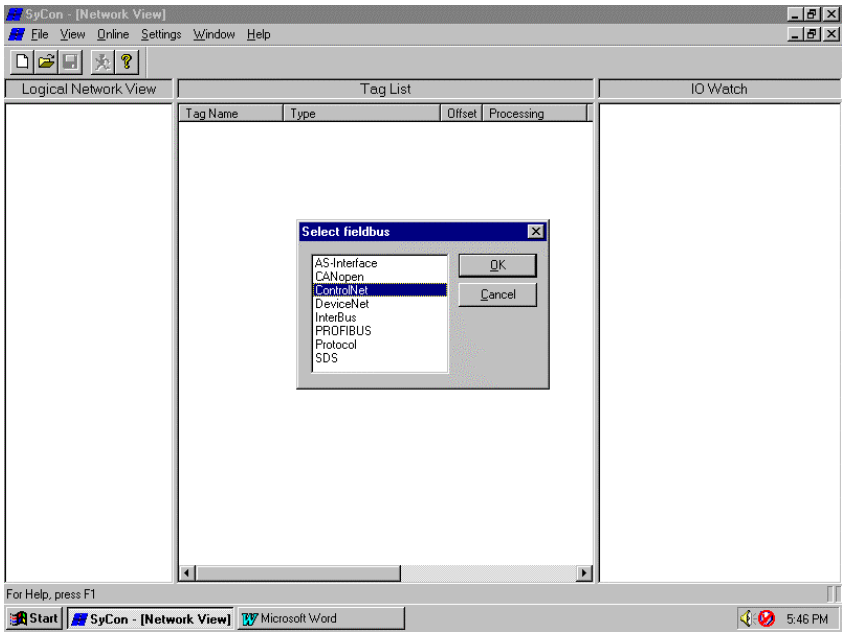
The fieldbus characteristics of the PMAC Gateway are defined in EDS files that come with the SyCon software. The ControlNet slave is defined in COMCNS.EDS. The configuration/diagnostic port on PMAC Gateway provides a convenient method for configuration and for monitoring the fieldbus side of the PMAC Gateway. The following section provides an example of how to use Sycon and the diagnostic port to configure and monitor the PMAC Gate

ControlNet SyCon Configuration

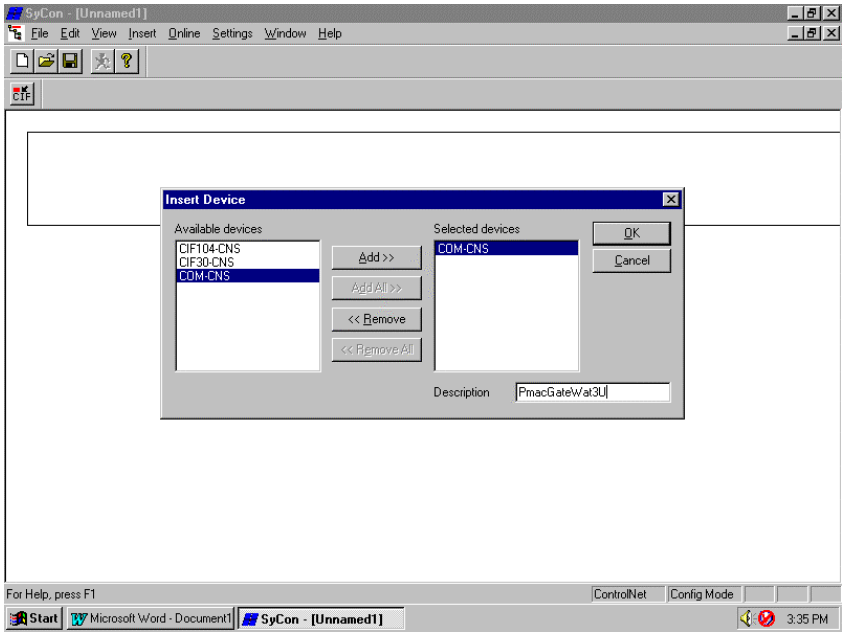
Start SyCon and start a new setup file.



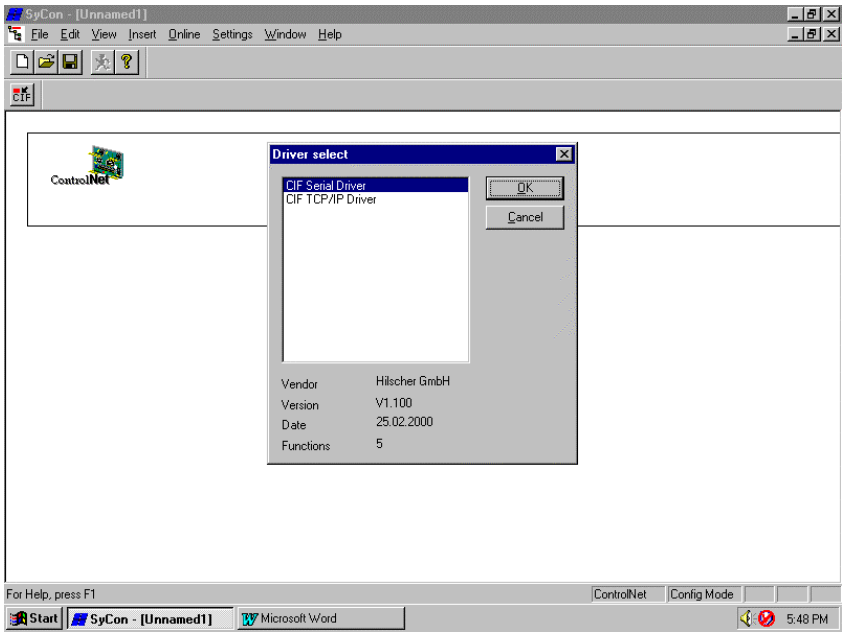
Select **ControlNet** as the fieldbus.



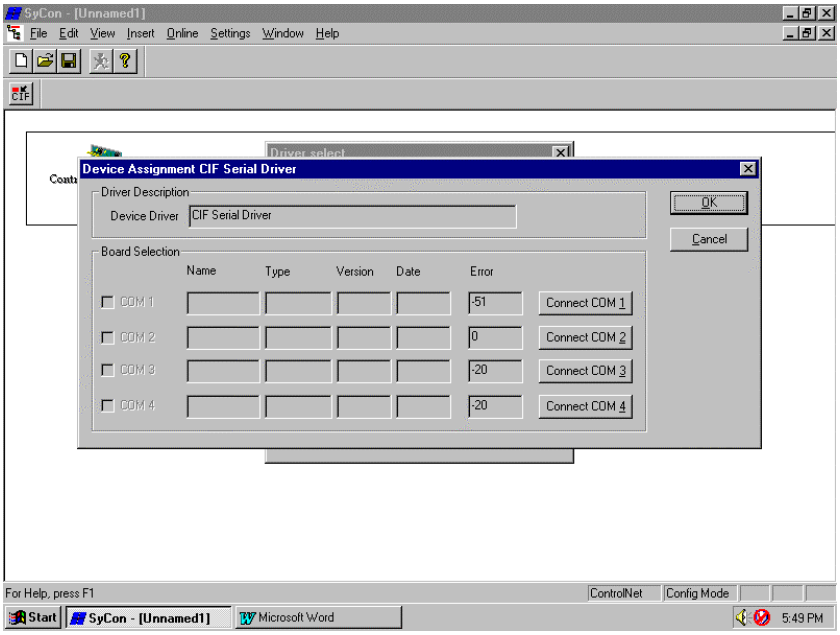
Choose **Insert-Device** or click the icon in the left corner of the screen. Add **COM-CNS** as the selected devices and press **OK**.


SyCon - [Unnamed1]
File Edit View Insert Online Settings Window Help
Insert Device
Available devices
CIF104-CNS
CIF30-CNS
COM-CNS
Add >>
Add All >>
<< Remove
<< Remove All
Selected devices
COM-CNS
OK
Cancel
Description
PmacGateWat3U
For Help, press F1
ControlNet
Config Mode
Start
Microsoft Word - Document1
SyCon - [Unnamed1]
3:35 PM

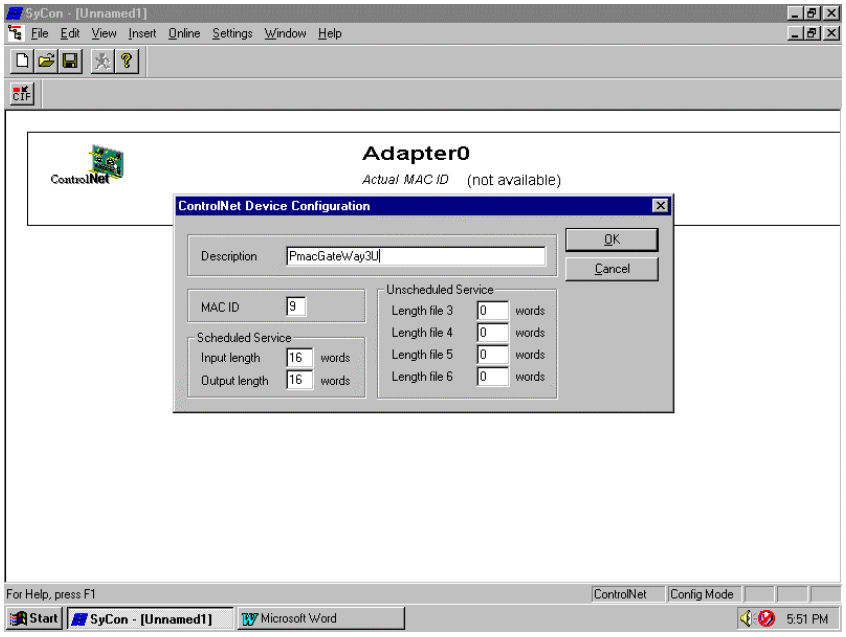
Establish communications to the PMAC Gateway in **Settings – Device Assignment**. Select **CIF Serial Driver**.



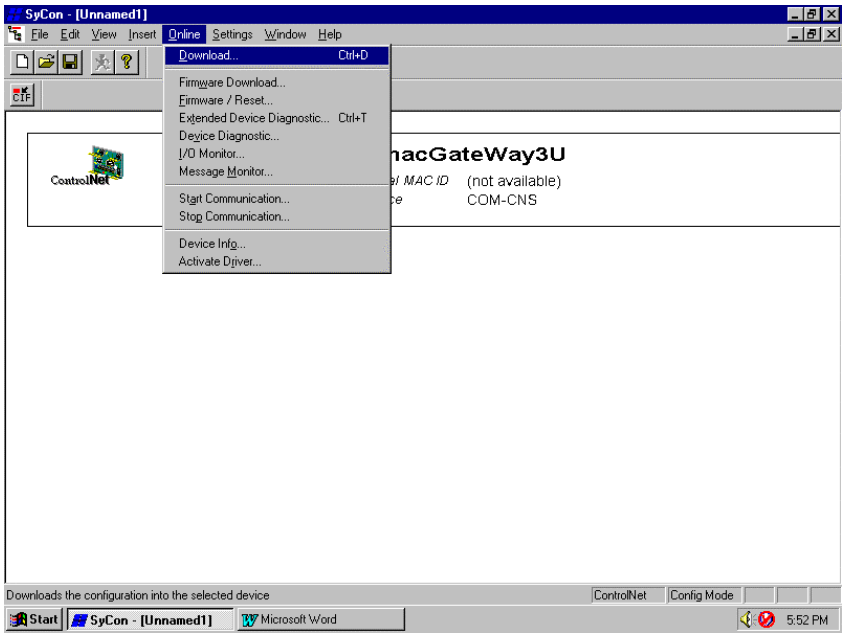
Choose **Connect COM n** depending on the COM port that is connected.



Configure the settings of the PMAC Gateway. In the Device Configuration, the MAC ID is equivalent to the Node number. The Input Length and Output Length will correspond to the Input and Output settings in ControlLogix.

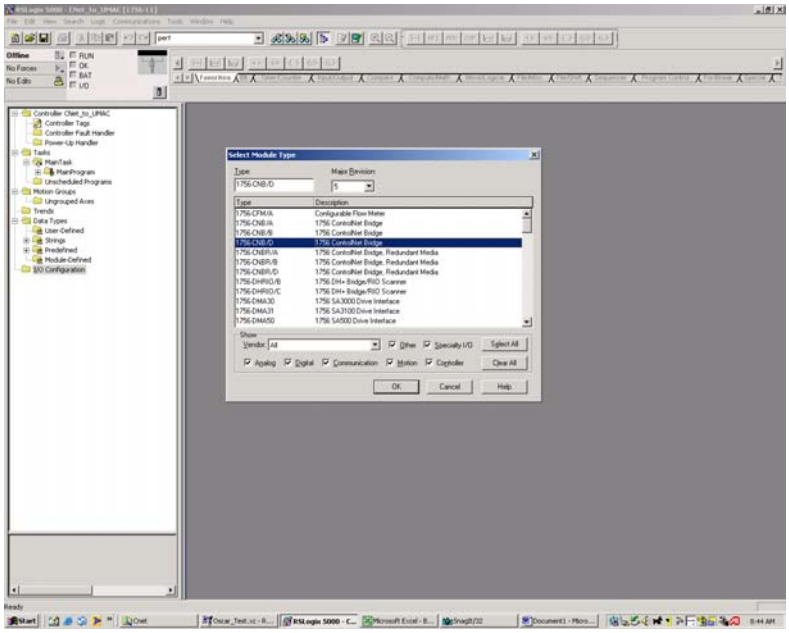


Download the configuration to the PMAC Gateway. Note that downloading the configuration to the PMAC Gateway saves it automatically and resets the PMAC Gateway.

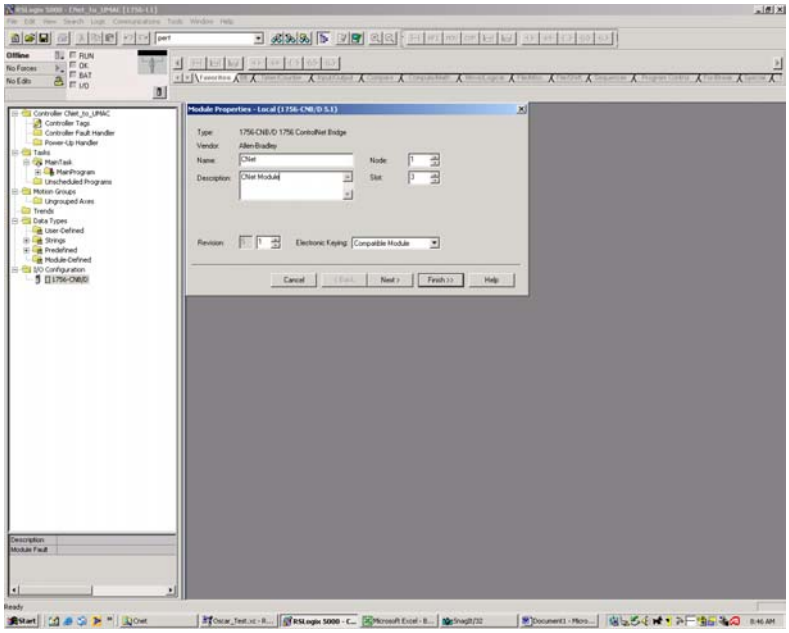


ControlNET for ControlLogix Configuration

In the RSLogix 5000 software under I/O configuration module folder, right click and select **New Module**. Select the type of ControlNet bridge that is in the Allen Bradley rack along with the Major Revision.

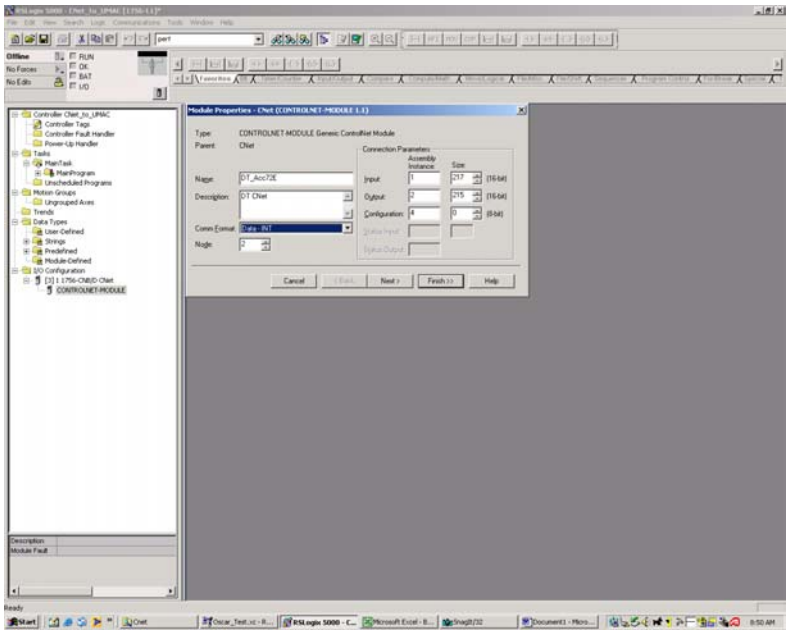


In Module Properties, assign a name and description for the device. Indicate what slot it is in the rack and what node is selected by the switch.

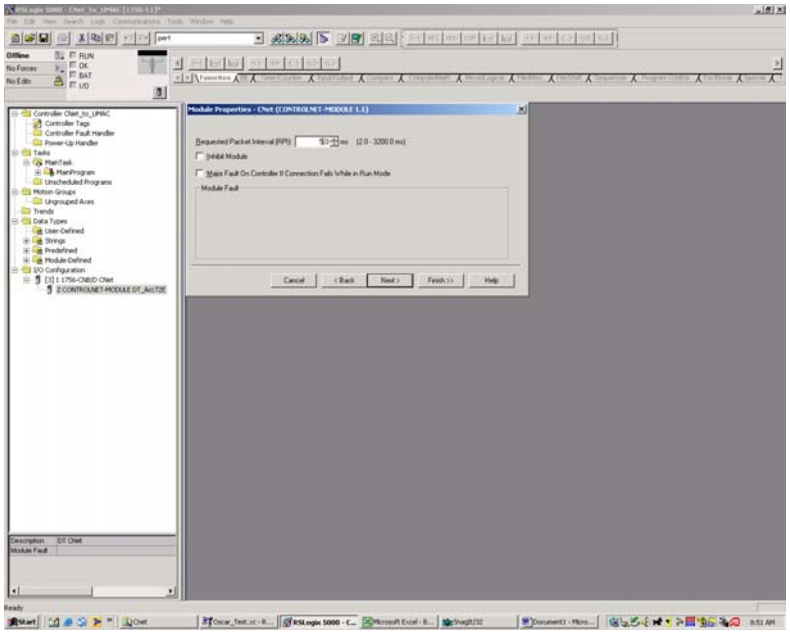


Right click on the ControlNet Bridge that was just inserted and select **New Module**. Select module type **CONTOLNET-MODULE** with description **Generic ControlNet Module**. This will be the PMAC Gateway ControlNet adapter. In Module Properties, enter a name and description for the device. Select **COMM Format Data-INT** and indicate what node was assigned during the software configuration with SyCon.

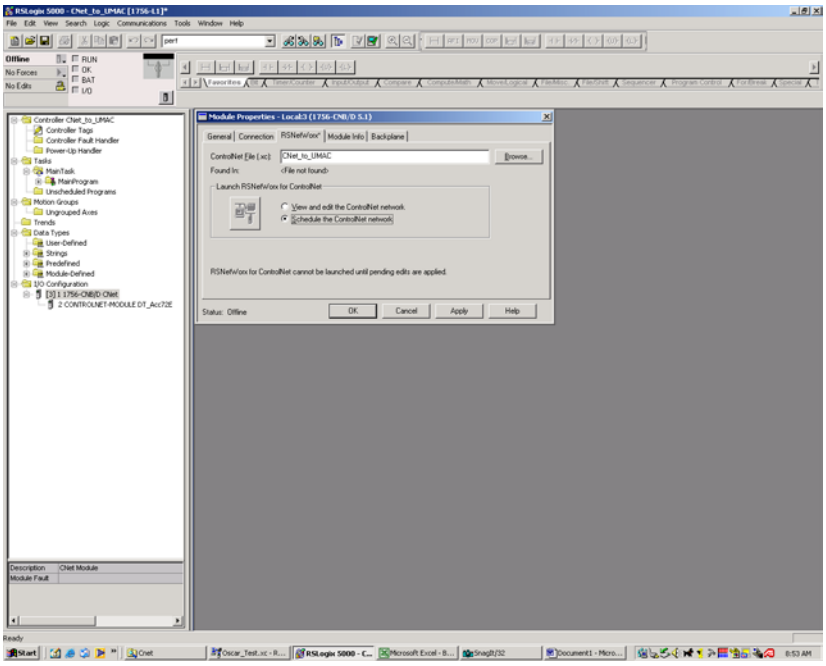
In the Connection Parameters box, the Assembly Instances and Sizes must be configured. The Input is Assembly Instance=1 and Size= Inputs +2. The Output is Assembly Instance=2 and Size= Outputs+0. The size of the inputs and outputs correspond to the Input Length and Output Length that was assigned for the Scheduled Services with SyCon and then downloaded to the PMAC Gateway ControlNet adapter. So if the Input Length = 215 words and Output Length = 215 words with the SyCon software, then the Size in RSLogix 5000 would be Input = 217 and Output =215. Lastly for Configuration, Assembly Instance = 4 and Size =0. Then select **Next**.



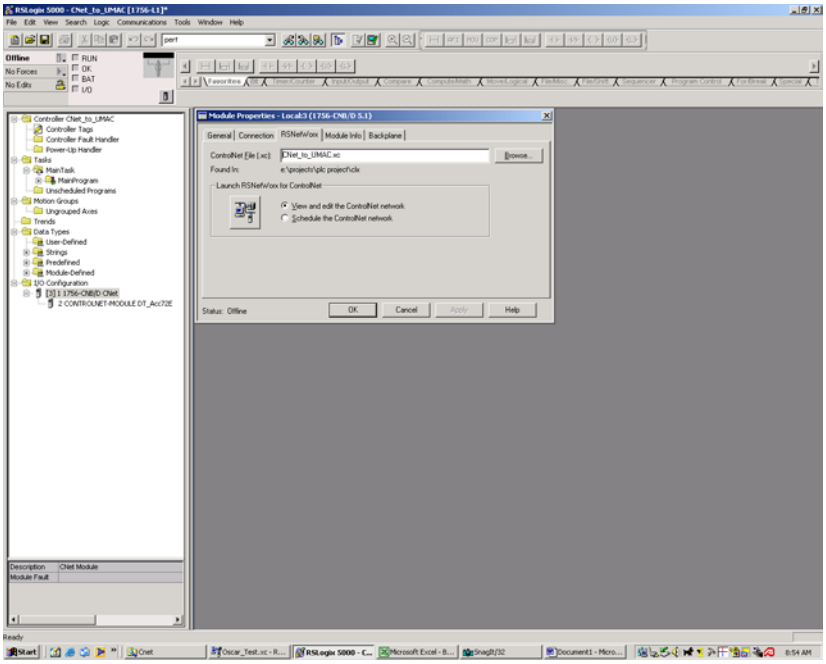
Set the Requested Packet Interval rate (RPI). In this example, it is set at 5 ms. The RPI can be set at different rates but it cannot be faster the slowest RPI. This value is sometimes set by trial and error. Select the Finish button.



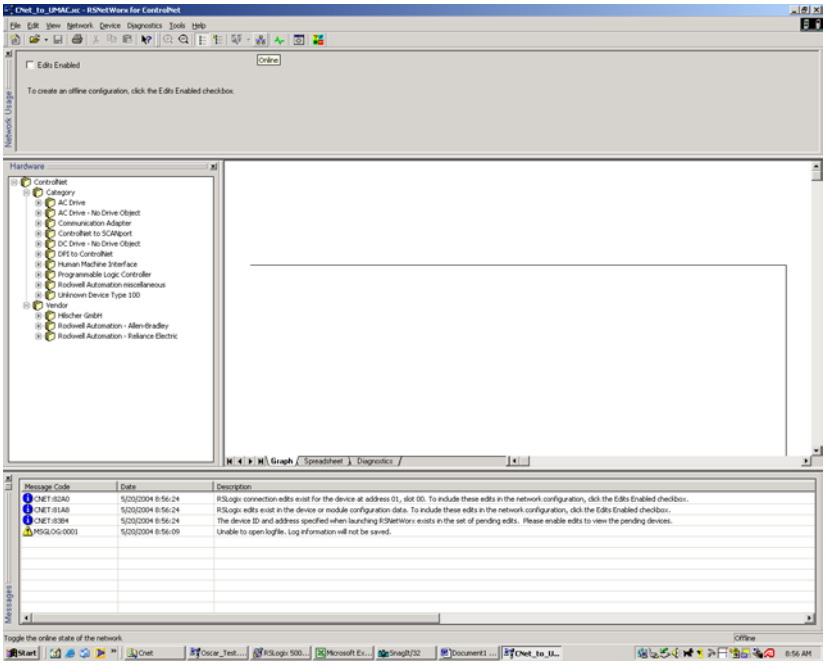
Return to the ControlNet Bridge, right click, and select **Properties**. Go to the RSNetWorx tab and create a ControlNet_file. Select **Schedule a ControlNet Network** and click **Apply**.



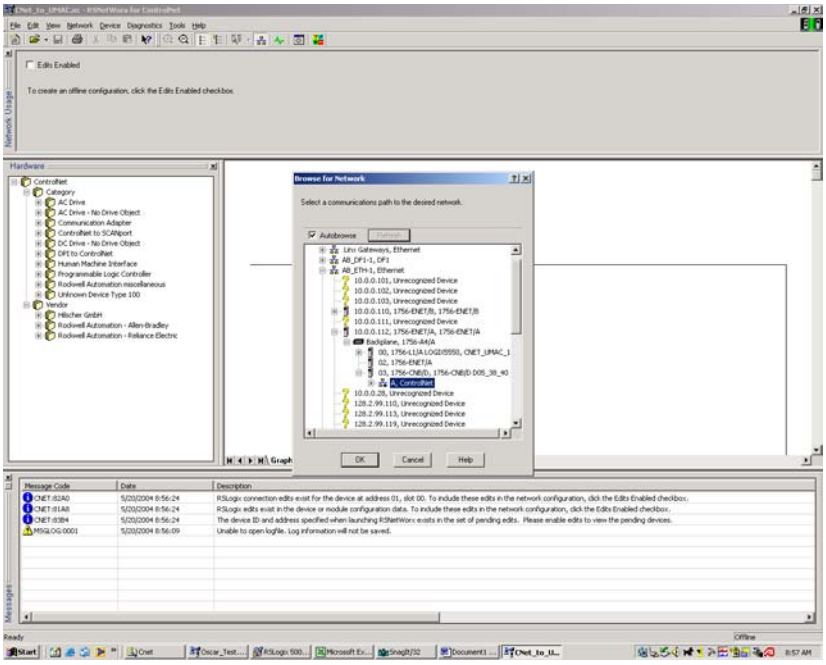
Now select **View** and **Edit the ControlNet Network** and click the network icon button the left.



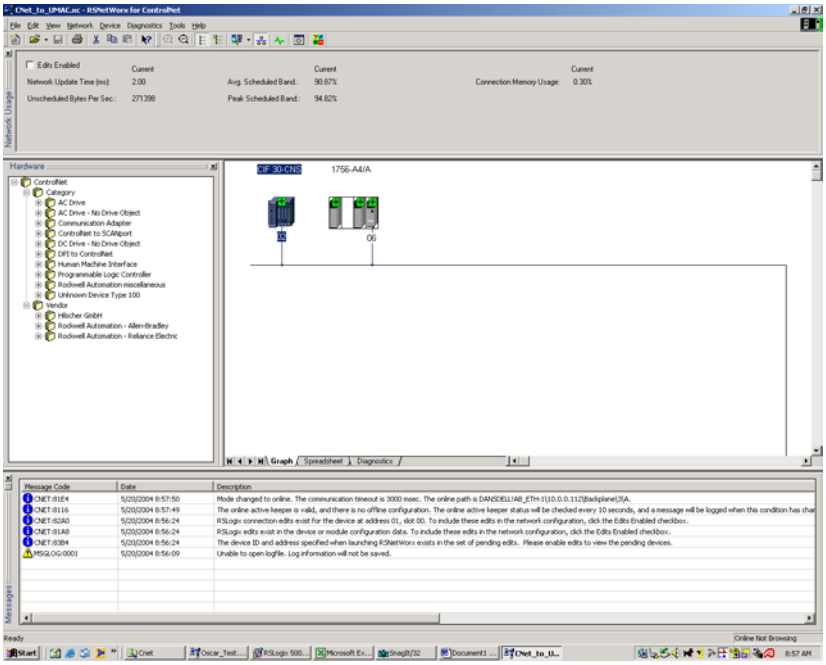
Once RSNetworx has launched, a network must be selected. Select the Online icon as indicated below, or select **Online** from the Network menu.



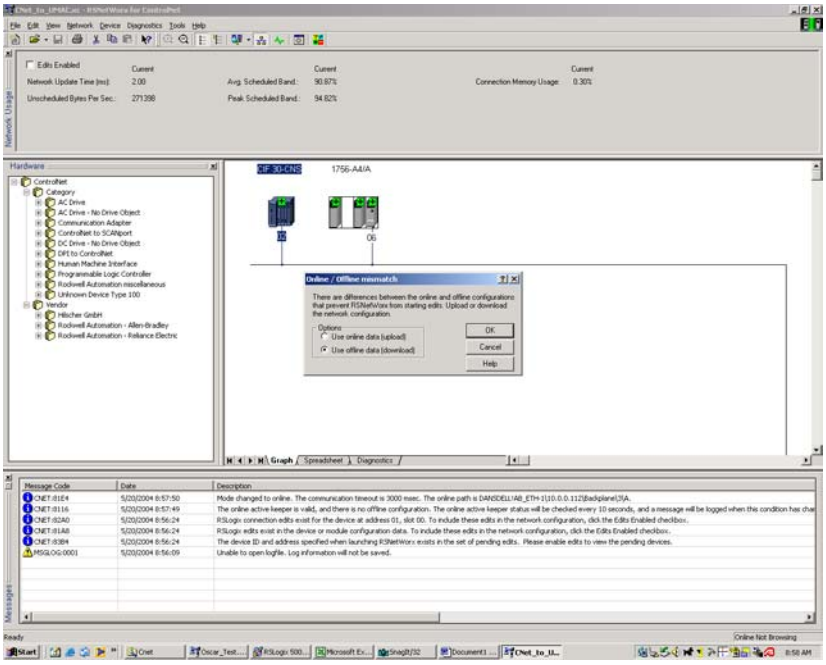
In the Browse for Network box, select the communication path the network is using. Find the ControlNet Bridge that was selected to communicate to the PMAC Gateway ControlNet adapter and select the network below it. Then click the **OK** button.



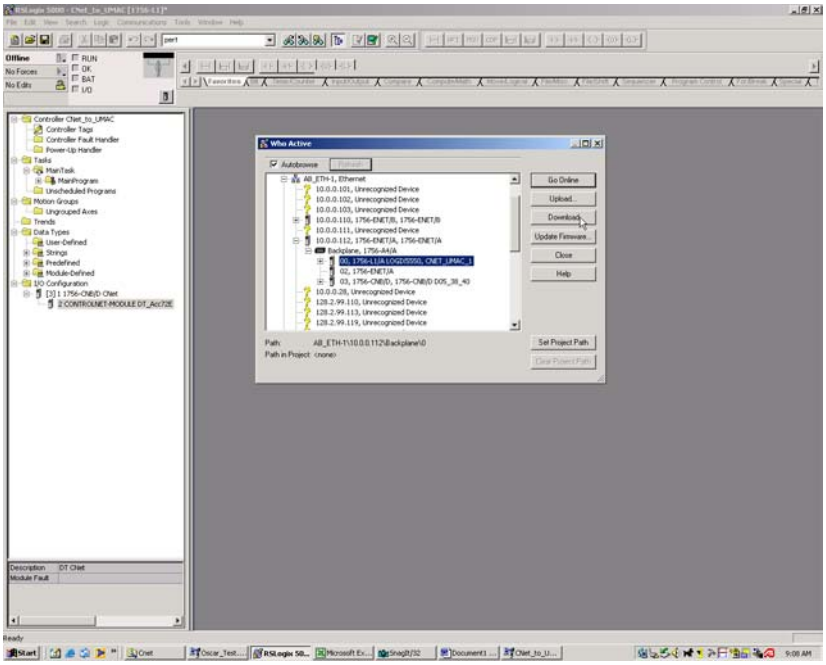
The ControlNet network will appear with the ControlNet devices along with the Allen Bradley rack.



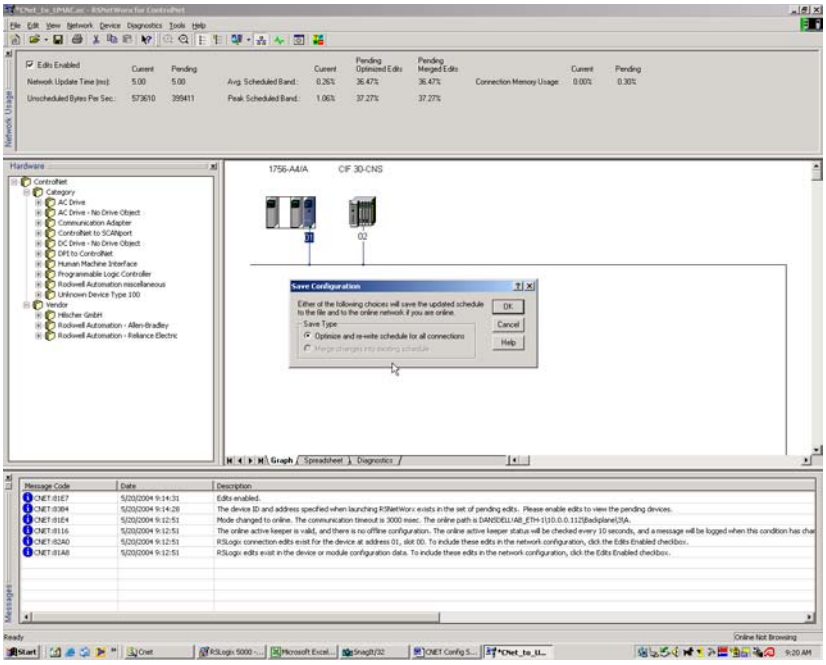
Now select **Edits Enabled** and the Online/Offline mismatch dialog box will appear. Select **Use offline data (download)** and click **OK**.



Return to RSLogix 5000, go to the Communications menu and select **Download**. If the communications path has not been specified to the ControlLogix controller then the path must be selected in **Who Active**. Once the path to the controller has been specified, then select **Download**.



Return to RSNetworx. With Edits Enabled, the ControlNet network can be saved by selecting the Save icon. The network can be optimized while the Edits are enabled by changing the Network Parameters in Properties under the Network Menu. These changes will take effect only after a save is issued. Then the Network is now configured. Return to RSLogix 5000 and save the file.



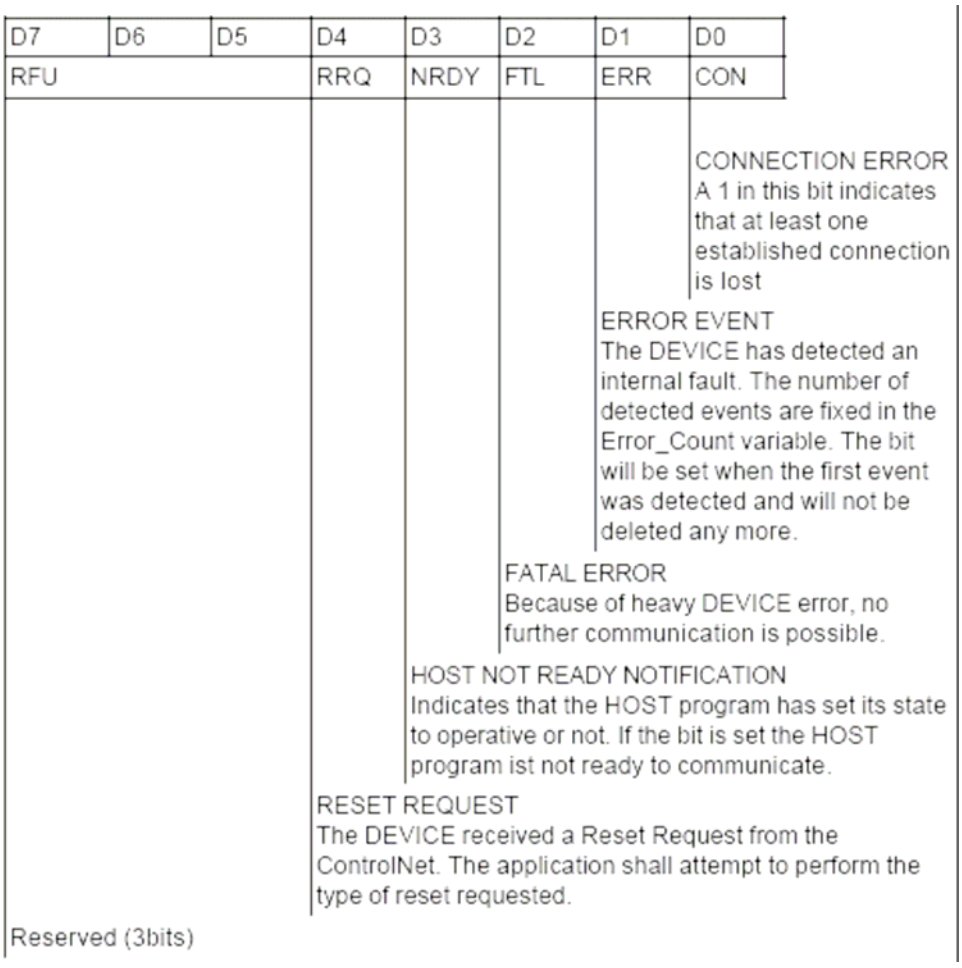
Monitoring Online Diagnostic Flags from PMAC

Once communications are established to all devices in the fieldbus network, diagnostic flags build into the gateway module can be monitored by PMAC to determine the status of the network during online communications.

ControlNet Slave Diagnostics

Variable	Size	Offset	Description
Global_Bits	1 byte	740H	Global error bits
Cns_State	1 byte	741H	Main state of the DEVICE system
Mac_ID	1 byte	742H	Current configured MAC ID
CNet_State	2 byte	744H	Status instance attribute of the ID object

- **Global_Bits**



- **Variable Cns_State**

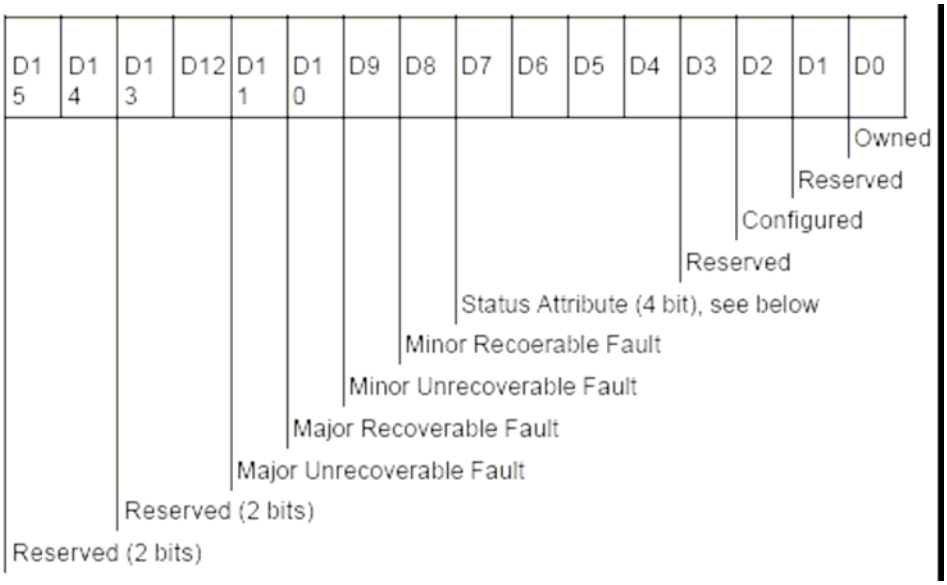
This variable represents the main state of the DEVICE system. Following values are possible:
00h: state OFFLINE
40h: state STOP
80h: state CLEAR
C0h: state OPERATE

- **Mac_ID**

The current (configured) MAC ID appears here.

- **CNet_State**

This variable represents the current status of the DEVICE. Its value changes as the state of the DEVICE changes.



Explanation of CNet_State:

Bit	Name	Signification	
D0	Owned	not used	
D2	Configured	A 1 indicate that the DEVICE has been configured. This do not inculde configuration of the communication.	
D4, D5, D6, D7	Status Attribute	0 0 0 0	Self Testing (power up)
		0 0 0 1	not used
		0 0 1 0	Communication Fault (lost communication)
		0 0 1 1	Awaiting Connection
		0 1 0 0	Configuration Bad
		0 1 0 1	Major Fault (see bit D10 and D11 for details)
		0 1 1 0	Connected, Active
		0 1 1 1	Idle
		1 0 0 0 - 1 1 1 1	Reserved, not used
D8	Minor Recoverable Fault	not used	
D9	Minor Unrecoverable Fault	not used	
D10	Major Recoverable Fault	A 1 indicate the DEVICE detected a problem, e.g. the task detected an invalid MAC ID.	
D11	Major Unrecoverable Fault	A 1 indicate the DEVICE detected a problem, e.g. a user watchdog failure appears.	

CC-LINK

CC-Link (Control & Communication Link) is a Fieldbus network that processes both cyclic I/O data and acyclic parameter data at high speed. CC-Link was developed by Mitsubishi and today, it is managed by the CC-Link Partner Association (CLPA). CC-Link is a very popular network in Asia. Worldwide, it is used for time critical applications based on Mitsubishi Automation technology. CC-Link products are certified by the CLPA, guaranteeing worldwide compatibility

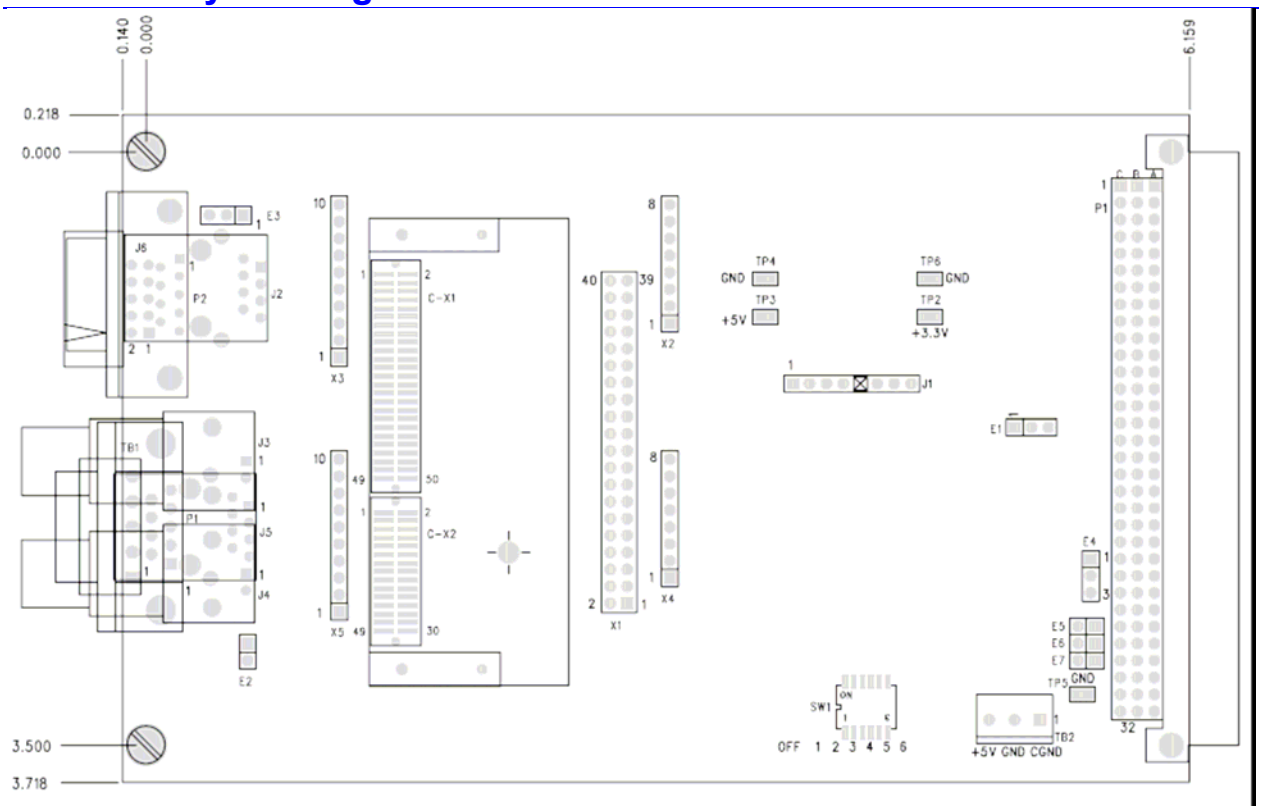
CC-Link is a Fieldbus for high-speed communication between controllers and intelligent field devices like I/Os, sensors and actuators. In networks with up to 65 stations, it provides reliable communication without any need for repeaters. Supported by a broad spectrum of automation equipment from many manufacturers, CC-Link provides communication facilities for integrated and efficient production or process facilities via a single cable. CC-Link includes many advanced features such as stand-by master function, detach and auto return Slave function as well as auto recovery from communication fault functions.

CC-Link incorporates an RS-485 topology and runs on a 3-conductor twisted pair cable. It can communicate to multiple devices on a single wire with a maximum length of 1.2 km at 156 kbaud without a repeater. CC-Link can communicate at speeds of up to 10 Mbaud at shorter wire lengths.

CC-Link Specifications

Size	3U x 4HP (UMAC Compatible)
Power Requirements	+5VDC, 500 mA (UBUS)
Connector Types	96 Pin UBUS interface
	10-pin IDC Male Diagnostic interface (ComPro)
	5 Position TB Connector
Dual Port Memory Size	8192 Bytes (8k)
Communication Maximum Size	96 Bytes
Inputs	48 Bytes
Outputs	48 Bytes
I/O Capacity	1024 Bytes (1k)
Baud Rate	125 k, 625k, 2.5M, 5M, 10M
Maximum Stations	64
Diagnostic RS232 Port	Yes
Program Storage	Flash Memory
Watchdog Timer	Yes
Operating Temperature	0-45 Degrees Celsius
Chip Technology	EC1
Lab Certified	Yes

CC-Link Layout Diagram

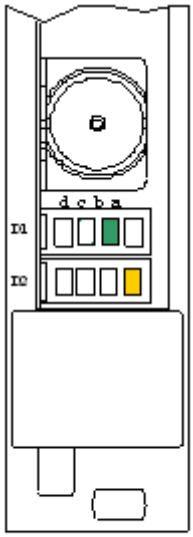


PMAC Gateway 3U CC-Link Version

CC-Link LEDs

Diagnostic LEDs

Diagnostic LEDs are provided to give visual indications of board status. The green LEDs are easy to understand. If the gateway card's b green LED and the daughter board green LED cyclic at the same frequency, it means the hardware is working properly. When the CC-Link cable is connected, both LED's will turn on and the fieldbus communications will be active. All the LED states are discussed below.

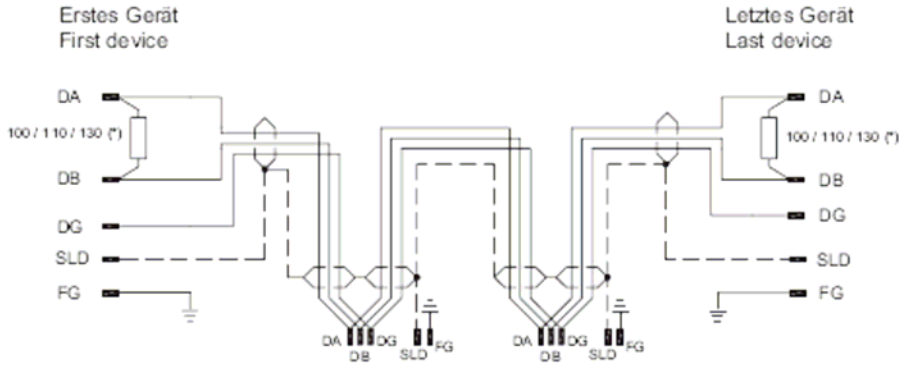


Diagnostic LEDs

Green LED D1-A	Not used in CC-Link version
Green LED D1-B	**ON** = Slave in cyclic data exchange with CC-link Master **Flashing cyclic at 5 Hz=** No error in the configuration found, communication is stopped or ready for communication but the device has no cyclic data exchange with the CC-Link Master **Flashing irregular=** Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host watchdog timeout **OFF** = No power or hardware/system error.
Green LED D1-C	**Flashing cyclic at 1 Hz=** Device is in bootloader mode and is waiting for firmware download **Flashing cyclic at 5 Hz=** Firmware download is in progress **Flashing irregular=** Hardware or heavy runtime error detected **OFF** = Ready
Green LED D1-D	Not used in CC-Link version
Yellow LED D2-A	**ON** = Connection to CC-Link Master established **OFF** = No connection to CC-Link Master
Yellow LED D2-B	**ON =** CRC error detected or station address not valid (valid is 1..64) or baud rate not valid (valid is 0..4) **Flashing cyclic at 2.5 Hz=** Station address or baud rate setting was changed since the last network controller reset **OFF =** No Error
Yellow LED D2-C	Not used in CC-Link version.
Yellow LED D2-D	Not used in CC-Link version.

CC-Link Typical Interconnection

Combicon-Schnittstelle / *Combicon Interface* 5-polig / *5 pin*	Pfostenverbinder / *Square Post Connector* 10-polig / *10 pin*	Signal / *Signal*	Bedeutung / *Meaning*	Farbe / *Color*
1	1	DA	Data A	blau / *blue*
2	2	DB	Data B	weiß / *white*
3	3	DG	Data Ground	gelb / *yellow*
4	9, 10	SLD	Shield	-
5	9, 10	FG	Field Ground	-



.

Only use cable types approved for CC-Link networks. CC-Link specifies shielded three-core Twisted Pair cables. It is recommended to use only one type of cable for an installation.

Please ensure that termination resistors are available at both ends of the cable. The value of the termination resistor depends on the used type of cable and can be 100, 110, and 130 ohms.

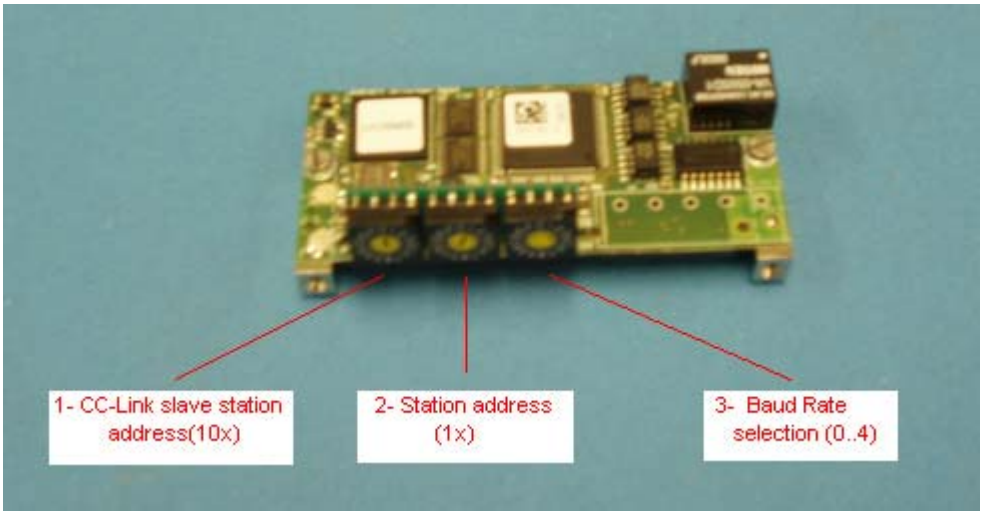
(*) For more information, go to the CC-Link Booklet (Hardware) in Appendix C

CC-Link Fieldbus Configuration

The fieldbus side of the 3U PMAC Gateway conforms to the CC-Link fieldbus standard. The characteristics of the fieldbus side of the 3U PMAC Gateway are hardware configurable. The daughter board, L0401813 by Hilscher, plug into the C-X1 and C-X2 connectors on the 3U PMAC Gateway mother board. The switch settings and the baud rate settings are shown in the following sections. CC-Link does not need a particular software configuration to provide communication. The hardware starts communicating at power up. Once the PMAC gateway card DPRAM registers are set up correctly, PMAC reads or writes data from/to the Fieldbus via CC-Link. This procedure is given in Appendix B.

CC-Link Fieldbus Switch Settings

There are three switches on the CC-Link Fieldbus, daughter board which are shown in the following picture.



The first and second switch set the CC-Link slave station address 10x and 1x respectively. The CC-Link slave station address can be set the range of 1 to 64. The third switch sets the baud rate to operate at the CC-Link network. It can be set the value of 0 to 4. The available baud rate settings are given in the next discussion.

.

CC-Link Fieldbus Baud Rate Settings

The CC-Link Fieldbus can be operated with five different baud rate settings. The valid baud rates are:

Identifier	Value	Baud Rate
CCLS_USR_BAUD_156K	0	156 kBit/s
CCLS_USR_BAUD_625K	1	625 kBit/s
CCLS_USR_BAUD_2500K	2	2.5 MBit/s
CCLS_USR_BAUD_5M	3	5 MBit/s
CCLS_USR_BAUD_10M	4	10 MBit/s

APPENDIX A — SYCON MANUAL

The Sycon2 (universal system configuration software) Operating Instructions from Synergetic™ are reprinted here as Appendix A.

Operating instructions

SyCon 2

Universal System Configurator Software

Overview

SyCon is a universal fieldbus configuration tool developed by Hilscher Corp., which we are initially using to configure the PmacGate-Way. SyCon can configure the fieldbus systems like ProfiBus, Interbus, SDS, DeviceNet, CANopen, etc. with a common tool that provides consistent user interface for all protocols.

SyCon allows you to configure all master and slave devices using one tool. SyCon checks the dependencies between the devices, checks for configuration conflicts and warns you of possible errors. Some protocols support standardized files containing information about all features and limitations of the slave device. SyCon uses these files for the configuration.

After the configuration, you can switch SyCon into a diagnostic mode. In diagnostic mode, you can watch all status information of devices connected to the network. For example, you can see the node list or slave diagnostic information. If a slave is not operating correctly it will be displayed in a different color, normally red.

SyCon consists of a **universal.exe** - file and several specific protocol DLLs. Most customers will use SyCon for only one bus system however SyCon can be expanded later by adding one or more DLLs for other available protocols.

2.0 Installation System Requirements

PC with 486 Pentium processor or higher
Windows 95, Windows NT 3.51, Windows NT 4.0
Free disk space: minimum 10 MB
RAM: minute 16 MB
Graphic resolution: 800 x 600 pixel or greater
Floppy Disk 1.44M or CD Rom

You have to install:

1. The system configurator
2. The device driver
3. One of the fieldbus protocols (ProfiBus, SDS, DeviceNet, Interbus S,..)

3.0 Installation Procedure

1. Close down **all** application programs on your system.

2. Insert the installation disk 1 (or CD) of SyCon in your floppy or CD drive.

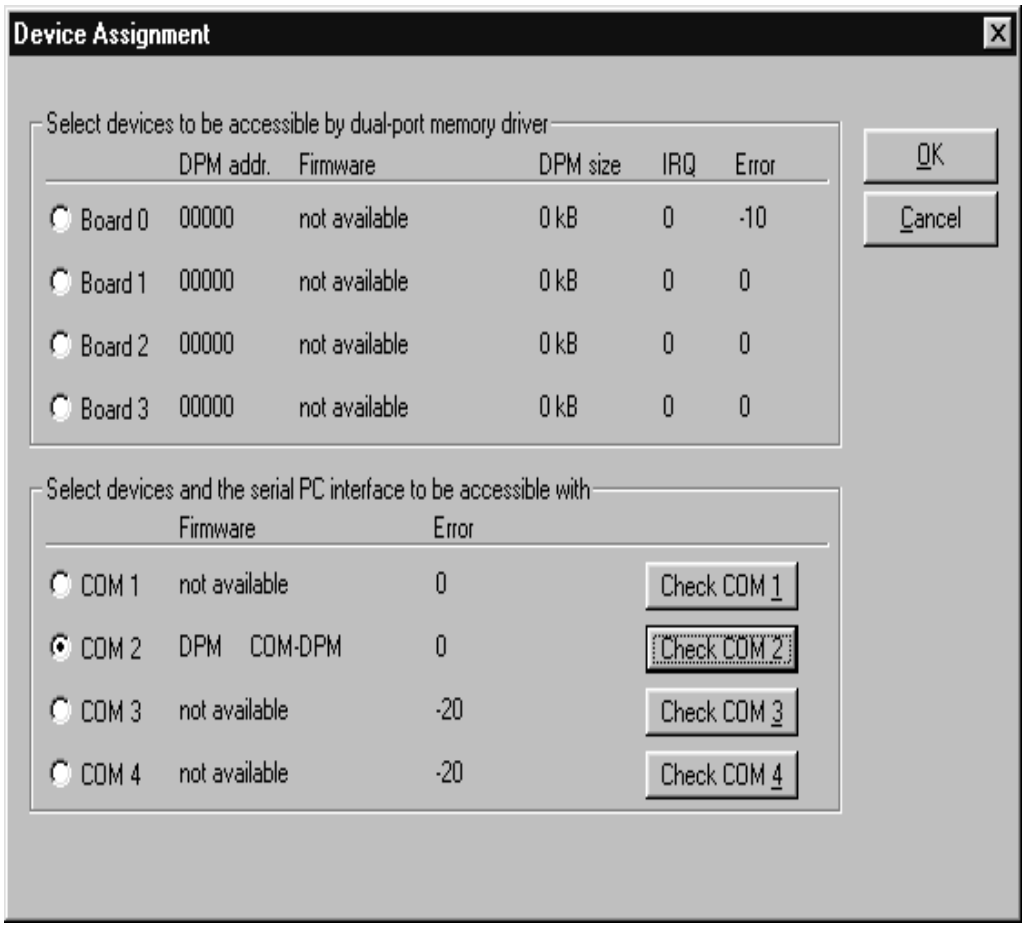
3. To install SyCon select the **Software-install** icon in the **start-settings-control panel** menu or select the command **Run** from the start menu of Windows 95 or Windows NT and type **a:\setup.exe** (**a:** is the letter of your floppy drive) and select **OK**.

4. Follow the instructions of the installation program and answer each question with **OK** or **Next**. The installation program will ask you for additional components (fieldbus system and device driver) to install. Install all parts. Without installing a fieldbus system SyCon is not able to run the configuration. The device driver is necessary to access the PC interface card in your system. Of course you can install these components by using their own setup programs later. Depending on the selected components (fieldbus/device driver) insert the disk and the corresponding setup program will be started automatically.

4.0 Configuration of the Device Driver

The program **Driver Setup** program configures the **DPM base address** and the **DPM size** for the device driver (DPM is dual-ported memory).

If you have a SMS-CIF30-DPM and you have not changed the jumpers of the board, you can use the default value in the window **Driver Setup Windows NT**. Otherwise, this must be done according the selected start address of the CIF board and the type of the CIF. If you have the SMS-CIF30-DPM then the **DPM size** is **2 KByte.** If the board is the SMS-CIF30-PB then you have to select **8 KByte**. If you have jumpered an interrupt on the board then you have to select the **Interrupt number**. The default interrupt is 7. After you have changed the settings you must reboot your PC to activate the parameters.



5.0 Configuration ProfiBus DP with SyCon

SyCon helps you to configure your ProfiBus DP system quickly & easily.

Follow these steps:

1. First select the fieldbus system and create a new file. Select the **File-New-ProfiBus** menu item. SyCon will start the configuration mode and opens the window for the bus. Insert all the Masters that you will have on the bus. If you do not find your Master in the list choose **Unknown FMS Master**, **Unknown DP Master,** or **Unknown Combi Master ProfiBus-DP**

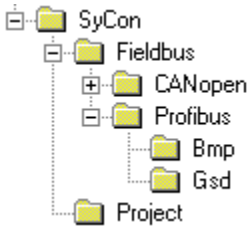
2. First you have to insert the DP slaves and assign them to their master. The next step is to configure these DP slaves with the actual I/O modules, and their parameter data. Be sure that you have selected the right addressing mode.

3. Save your configuration. Select the board as actual device, which you want to configure and download(s) to all the CIF devices. Connect the bus cable, and test the communications using the I/O-Monitor for DP, and the FMS Monitor for FMS.

4. Finally, print out the documentation of your ProfiBus system.

GSD Files

Each **ProfiBus-DP** manufacturer uses standard device description files to define the ProfiBus-DP device on the network. **These definitions are called GSD files.** The set of device description files (GSD file) build the device database.



All possible devices the configuration or GSD files must be in the GSD directory during the startup of the SyCon software. If you need another GSD file during SyCon runtime you have to copy this file with the **File - Copy GSD** menu item.

Note: You need GSD files only for ProfiBus-DP.

The GSD directory path is changeable. To modify it from the default to an another path use the Settings **– Path** menu. All GSD files have to be present in this directory for SyCon to recognize the device.

Selecting a fieldbus system and creating a new file

At the beginning of a design, you must create a new configuration file, which is done in the **File – New** menu item. You can select between the different fieldbus systems Select **ProfiBus**.

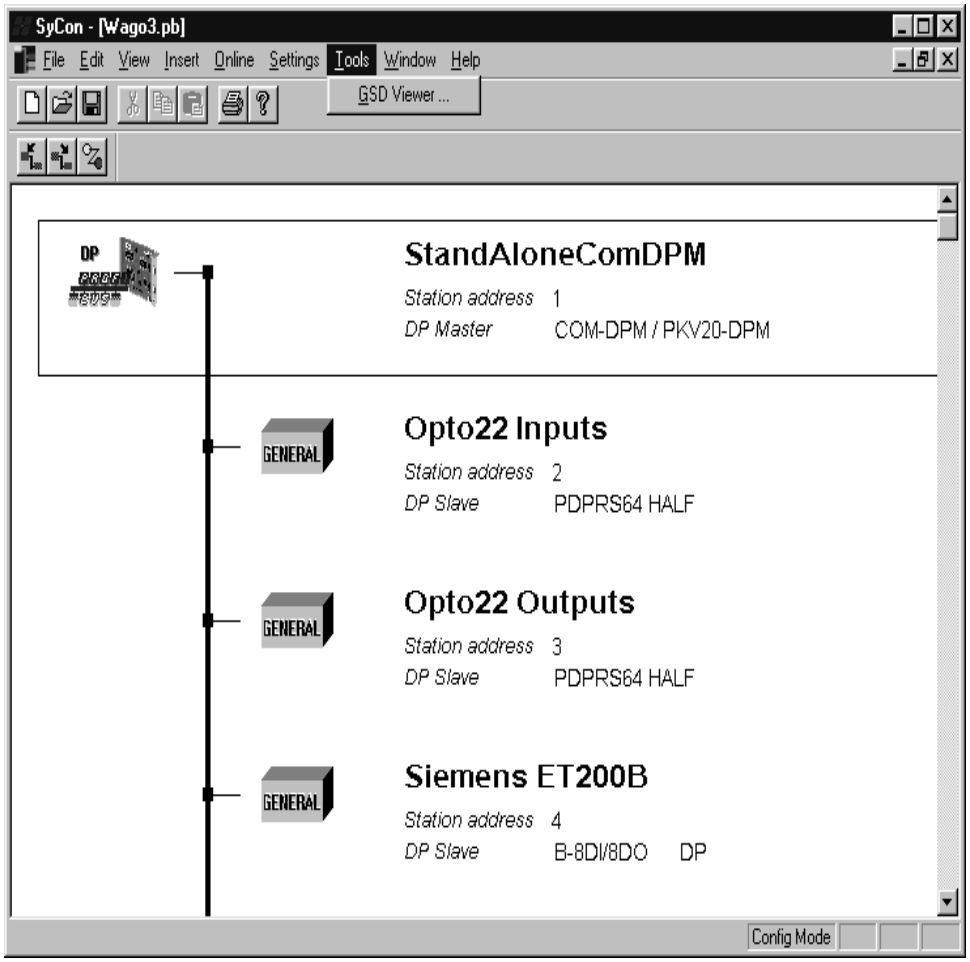
The name for the configuration can be assigned when you leave the system configurator or using the **File - Save AS** menu.

Insert Master

To insert a new master in the configuration select the **Master** item in the menu **Insert** or click the following icon:

The mouse cursor changes to the insert master cursor. Click on that position, where you want to insert the new master. A dialog box appears where you have to select one or more masters. You can select the master types:

ProfiBus Combi Master (ProfiBus-FMS and ProfiBus-DP)
ProfiBus-FMS Master



ProfiBus-DP Master

Settings

Bus Parameter

The bus parameter is normally the baud rate of the fieldbus network, which is determined by the master controller. Each fieldbus has a set of different baud rate options.

In a ProfiBus-DP system, the only parameter, which is required, is the baud rate. The baud rate of the ProfiBus is common for all bus nodes. Changing the baud rate causes all other parameters to be re-calculated. The System Configurator checks that all configured devices based on the information in the GSD file support the baud rate.

If the System Configurator finds at least one device in the configuration that does not support the selected baud rate an error message appears, because this information is missing in the device description file. The user can check the actual parameter, if he opens the **Actual Bus Parameter** window with the **Edit** button. Some of the parameters can be changed individually. Please note if you make any changes in the bus parameters the parameter for the **Optimize** field must be changed from **by SyCon** to **by User**.

Caution: Changing the bus parameter can stop the communications

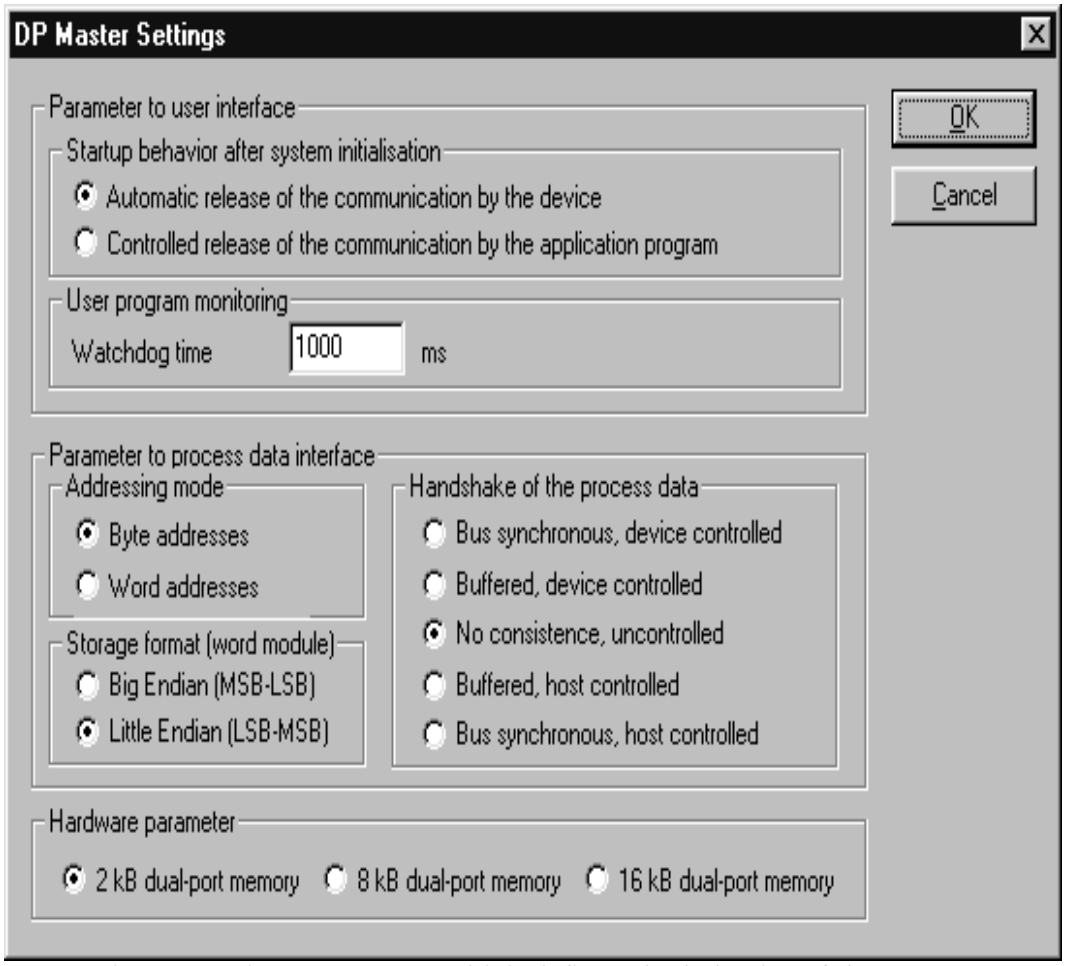
The **Highest Station Address** is the highest bus address up to which the master will search for another active master station to transfer the send permission. This value should not be set below the master address.

The field **Watchdog control / TTR** allows the user to enter a factor to control the watchdog time of the slaves. If this factor is chosen to large, it is possible that the slaves could set their outputs to Zero .

With the **Auto Clear** flag it is possible to select a global error flag. The Master controls the process data transfer for the slaves with a timer. If the data transfer is not successful during one data control time interval with activated option **Auto clear modus on,** then the Master leaves the user data transfer and switches the outputs of all assigned slaves to the fail-safe state**.**

Master Settings

To enter the master settings select the **Settings - Master Settings** menu or use the right mouse button at a DP master device. There is also a **Master Settings** button in the **Master Configuration** window available.



The Master settings contain parameters, which defines the behavior of the PMAC GatewayDPRAM.

Startup behavior after system initialization

If **Automatic release of the communication by the device** is selected, the master starts with the data transfer on the bus when initialization is finished. If **Controlled release of the communication by the application program** is selected, the user has to start the data transfer on the bus, by a defined release procedure.

User program monitoring

The watchdog time appointed how long the device will wait for a user trigger of the watchdog, upon a watchdog all outputs are set. This procedure must be activated by the user application software and is not started automatically.

Addressing mode

The addressing mode of the process data is how to interpret the addresses of the process image. There are the possibilities **Byte addresses** or **Word addresses**. For performance reasons the PMAC Gatewayworks internally with word structures. Therefore if you have configured the **Byte address** mode, the data for the slaves modules starts on even addresses.

Storage formats (word module)

The storage format fixes the format, how the data is placed and interpreted in the process images. For data types, the **Little Endian** format and **Big Endian** format can be selected.

Handshake of the process data

Different modes of handshaking the process data can be selected for the master. The selection of this mode is important for the correct data exchange between the application and the device.

Hardware parameter

With this parameter you select the size of the dual-ported memory of the hardware. The parameter will enlarge or reduce the possible value ranges for the I/O offsets.

Addressing mode

The addresses in the configuration data of the devices determine the starting points of the corresponding data in the process image.

Byte address The process image has a byte structure and every byte has its own address.

Word address The process image has a word structure and every word has its own address. This has nothing to do with the physical data size of the dual-ported memory, which is always byte oriented! The following table shows how the different data types in the process image in byte or word address mode:

IEC Address		Offset address in the dual-ported memory (first 8 bytes)	Data in the Process Image (example)	Output in Little Endian format - byte module - module with two single bytes - word module
in **byte** mode	in **word** mode			
		0	0000 0000	
		1	0000 0000	
QB 2	QB 2	2	1110 0010	Output QB2 / QB1 D7 D6 D5 D4 D3 D2 D1 D0 ❶ ❶ ❶ ⓪ ⓪ ⓪ ❶ ⓪
		3	0000 0000	
QB 4	QB 4	4	1111 1000	Output QB4 / QB2 D7 D6 D5 D4 D3 D2 D1 D0 ❶ ❶ ❶ ❶ ❶ ⓪ ⓪ ⓪
		5	0000 0111	D7 D6 D5 D4 D3 D2 D1 D0 ⓪ ⓪ ⓪ ⓪ ⓪ ❶ ❶ ❶
QW 6	QW 3	6	1111 1111	
		7	0100 0100	
				Output QW6 / QW3 in Little Endian format (LSB - MSB) D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0 ⓪ ❶ ⓪ ⓪ ⓪ ❶ ⓪ ⓪ ❶ ❶ ❶ ❶ ❶ ❶ ❶ ❶
				Output QW6 / QW3 in Big Endian format (MSB - LSB) D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0 ❶ ❶ ❶ ❶ ❶ ❶ ❶ ❶ ⓪ ❶ ⓪ ⓪ ⓪ ❶ ⓪ ⓪

Insert Slave

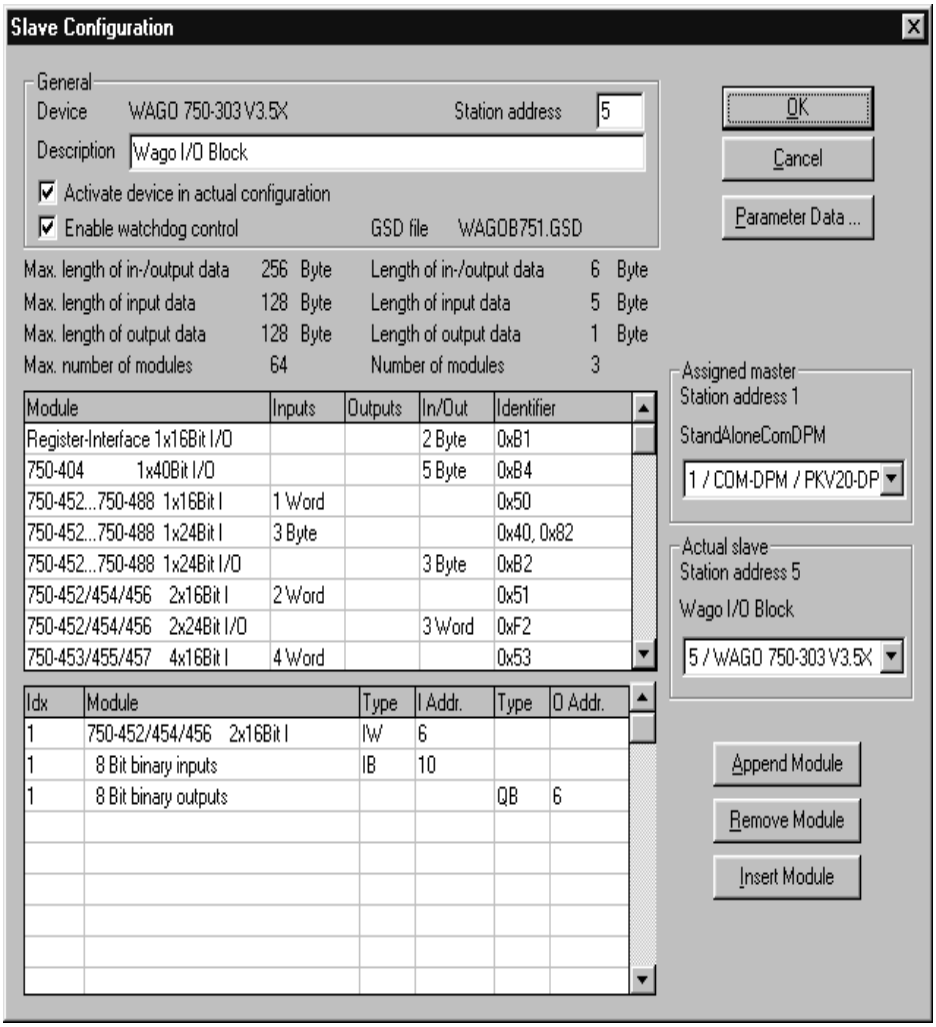
To insert a new slave in the configuration select the **Slave** item in the menu **Insert**. Click on that position, where you want to insert the new slave. A dialog box appears where you have to select one or more slaves.

In the left list box there are listed all slave devices which are presented in the GSD directory. If there are too many you can set a filter to select only a special slave family or vendor. When one slave is selected, you can see additional information about the slave in the list box below. With a double click or with the **Add** button the slave appears in the right list box. All devices in this box will be connected to the active master who is displayed in the window. If you select the slaves individually, you can give every device a name or a short description in the description field.

With the addition of every slave the station address is incremented, but this valve can be changed manually in the **Station address** field.

Slave configuration

The slave specific configuration is done in this window. Here you have to assign the modules and their data to addresses for the process data image in the master device. Remember that these addresses correspond to your application in the PC.



There are two types of slaves. A **simple slave, which** has a fixed data length, and a **modular slave, which has variable,** date length and is configurable. This type of slave can be understood as an assembly of one or more simple slaves with one bus address.

The upper table contains all available modules of the slave device. In the case of a simple slave there is only one module, which is already copied, into the lower table automatically by SyCon. If it is a modular slave, the user must do this with a double click on the module or selected module or by clicking on the **Append Module** button. If a module has several inputs or outputs, then it gets more lines in the configuration table. These additional lines will be assigned with a higher index in the Idx column.

To configure the modules of the slave do the following steps:

If not already present, select all modules from the upper table and insert them in the lower table. The sequence of the modules in the lower list is important and must correspond to the real physical slave configuration.

Assign the addresses of the module data in the process image for each module in the lower table. This is done in the columns **Type** and **Addr** for input and output separately.

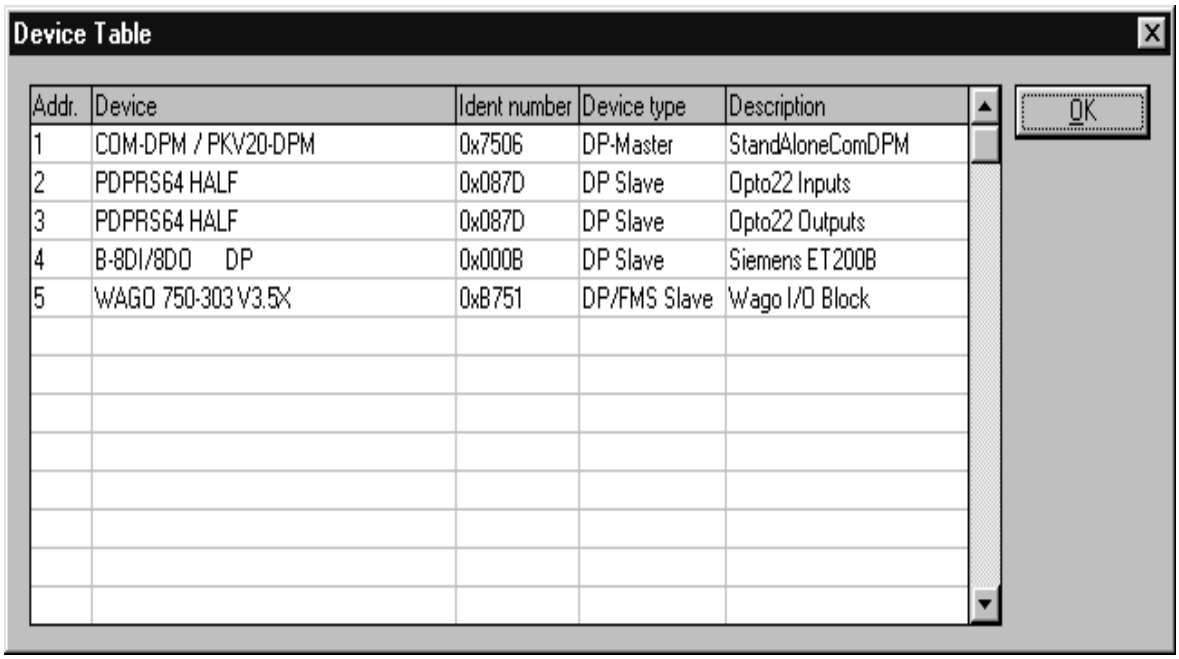
> The I/O address can be entered by the user or set automatically by SyCon using the **Auto Addressing** flag, which must be set in the M**aster Settings** window.

If the flag is active SyCon will place all I/O data offsets in physical order. This is done during the download procedure and the assigned addresses can be checked in the **Address Table**.

If the addresses are entered manually the default address 0 in the field **I Addr**. **O Addr** must be overwritten by the user. Depending on the **Addressing mode** in the **DP Master Settings** the addresses are byte addresses or word addresses. This is described in the chapter Addressing mode. The DP-Slaves use the **Watchdog Control** flag to detect communication errors of their assigned DP master. If a DP slave recognizes an interrupted communication to his master during a defined watchdog timer interval, when he was operational once, he resets himself and sets his outputs into a safe zero state.

> **Caution:** If Watchdog Control is switched off, it is possible that the slave will not reset slave outputs, even though the communication is broken.

DP Slave Settings



The DP Slave settings contain parameters, which define the behavior of the PMAC interface. To enter the DP slave settings select at first the slave than open the window with the menu **Settings - DP Slave Settings.**

User program monitoring

The watchdog time appointed how long the device will wait for a user trigger of the watchdog, until it resets all outputs to zero. This must be activated from the application.

Configuration mode

If the slave device should take the parameter out of the configuration which is downloaded from SyCon then you must select for the **Configuration mode** the mode **Configuration by SyCon**. If the configuration is written in the dual-ported memory from the application then you must select **Configuration by application**.

Handshake of the process data

With these different modes, the handshake of the process data is selected for the master. The selection of this mode is important for the correct data exchange between the application and the device.

Startup behavior after system initialization

If **Automatic release of the communication by the device** is selected, the slave is ready to communicate with the master when started. If **Controlled release of the communication by the application program** is selected, the user has to start the communication with the master.

Board Assignment

SyCon is able to configure all devices in a network. To run the online functions of such a device you must define how SyCon can communicate with it. This is done in the menu item **Board Assignment**. You have the choice between four boards, which are installed internally in the PC and four devices, which are connected with the serial port to the PC.

SyCon looks in the registry of the device driver and displays all boards that are available internally.

The externally connection can be checked with the buttons **Check COM 1** to **Com 4**. SyCon sends a request on that serial port and asked for the firmware. If there is a device connected the firmware is displayed otherwise there will be a time-out error.

Now you can assign the configured devices to the boards and to the serial ports. If the assignment for one device is done, it is no longer available in the select list for a further assignment. Therefore if you want to change an assignment, you have to select **No device** instead of a device, before you can get the device in the selection list for or other board or serial port.

Viewing, Printing and Saving Your Configuration

View Device Table The list of devices is displayed with the menu item View - Device Table.

Address Table To display the list of salve addresses use the menu item View - Address **Table**. Select the master as actual master to display its' address table.

CRL Table (ProfiBus) Display the Communication Reference List.

OD Table (Profibus) The Object Directory is displayed with the menu item View - OD Table.

Print After you have selected the actual printer with the menu item **Print Setup** you can print out the configuration with the menu item **Print**. If you want to have a preview of the print before printing you can use the function **Print Preview**.

Save You can save the configuration with the menu item **Save** if the file name is known otherwise you must use the function **Save as** with a new file name.

Downloading the Configuration to PmacGate-Way
The download of the configuration data to the device can be started with the menu **Online - Download**.

At first you have to select the desired device, so that it is signed with a blue frame around it. This is done with the function **Actual Master** in the window **Master Configuration** or with the function **Select as actual master** in the menu which appears if you click with the right mouse button on a master device.

Before the download happens, SyCon will check the configuration. If there appears any error message, the configuration should be checked. Most errors are overlapping addresses, which can be located by looking into the **Address Table**.

The configuration will be transmitted to the selected device and stored in static FLASH memory, so that it is available after the power is switched off and on in this device.

Debugging
Debug Mode and Device Diagnostic

After you have selected an actual master, you can start the debug mode. From this time, SyCon requests the status of all slaves of the actual master. If there is an error on a slave the bus line to this slave is drawn in red otherwise it is green. SyCon also display the **Diag** message, if the slave signals diagnostic information. This information is displayed if you click with the mouse at the corresponding device in debug mode.

To activate the debug mode select the menu **Online - Start Debug Mode**. The menu **Online - Device Diagnostic** activates the DP slave diagnostic. To end the Debug Mode select the menu **Online - Stop Debug Mode**.

Device Diagnostic Descriptions:

Master_Lock	The slave has been parameterized by another master. DP master (class 1) sets this bit, when the address is unequal to 255 and unequal to the own address.
Param_Fault	This bit is set by the slave, when the last parameter telegram has an error, for example wrong length, wrong Ident_Number, invalid parameter.
Invalid_Slave_Resp	This bit is set by the master, when the master has received an invalid answer from the slave.
Not_Supported	This bit is set by the slave, when a function is asked to be performed but does the slave does not support.
Ext_Diag	This bit is set by the slave. If the bit is set, then there is diagnostic information in the slave-specific diagnostic area (EXT_DIAG_DATA).
Cfg_Fault	This bit is set by the slave, when the configuration data is not unequal.
Station_Not_Rdy	This bit is set by the slave, when the slave is not ready for data exchange.
Station_Non_Existent	This bit is set by the master, if this slave is not reachable on the bus. If this bit is set, the diagnostic bits holds the state of the last diagnostic information or the initial values.

Diag.Deactivated This bit is set by the master, when the slave in the slave parameter set is not marked as active and is take out of the cyclic processing.

Diag.Sync_Mode This bit is set by the slave, when he has received the sync-control command.

Diag.Freeze_Mode This bit is set by the slave, when he has received the freeze-control command.

Diag.WD_ON This bit is set by the slave, when its watchdog control is active.

Diag.Stat_Diag If the slave sets this bit, the master has to collect diagnostic information as long as this bit is active. The slave sets this bit for example when there are no valid user data. If the bit **Diag.Prm_Req** and the bit **Diag.Stat_Diag** are set, the bit **Diag.Prm_Req** has the higher priority.

Diag_Prm_Req If the slave sets this bit, a new parameterization has to be performed. This bit is set as long as no new parameterization has been performed. This bit is set from the slave.

Ext_Diag_Overflow If this bit is set, there are more diagnostic information as in EXT_DIAG_DATA given. The DP-slave set this bit for example if there are more channel information as the slave can hold in its send buffer; or the master set this bit, when the DP-slave send more diagnostic information, as the master can hold in its diagnostic buffer.

Diag.Master_Add In this octet the address of the master is entered, which has done the parameterization of the this slave. If the salve is not parameterized from any master, the slave put the address 255 (FF) into this octet.

Ident Code The identifier of the manufacturer is reserved for every participant. This identifier can be used for checks or can be used for an exact identification.

I/O Monitor

This is a simple tool, which allows displaying and entering at the first 32 bytes of the process image.

FMS Monitor (Profibus FMS)

This tool allows starting a ProfiBus-FMS service based on the configured objects and communication references. You must select on of the service **Read** or **Write** and the parameter in the select list. If it is a write, the output data are entered in the **Value** field. The service is activated with the button **Send**. At the left side of the window appears the confirmation.

Task States

Task states are online counters, values, parameters and states that can be displayed. Several task states are available. The **Online - Task State** menu activates a list of available structures. The listed structures can be displayed to show the values.

Error numbers

The following table lists the error numbers of the converting functions.

Number	Description
4000	No table existing
4001	Success in compromising
4002	Set not existing
4003	Last respectively first entry reached
4004	Not enough memory
4005	Directory table full
4006	Max number of entries reached
4007	No writing to this table possible, because the table is located in the FLASH
4008	Table name already exists
4009	File name does not exist
4010	Free RAM length from RCS_CNF.P86 is smaller than E_F_INDEX * 2
4011	Parameter next wrong
4012	Not enough free space to copy data set
4013	Set is deleted
4014	Value for Index is wrong
4015	Access not allowed
4016	Open_file used before init_file
4034	Length of converting stream is 0
4035	Non equal data set found
4036	Writing of set 0 is not allowed
4037	No entriy in this file
4038	Data set has length 0
4039	The function DbmInit has assigned a Zero pointer during RCS initialization
4040	Printer not ready
4041	The data base is used from another function
4042	New length of data base is smaller than used
4043	Unknown access mode
4044	Old data base has to be converted
4045	Error while converting. Function not known
4046	Unknown type in set 0 found
4047	No float function available
4048	Function not in RCS module
4049	Check failed
4050	Checksum ckeck failed
4051	More segments are existing in file, than in the structure FILE_INFO_T
4052	SegLen in structure FILE_INFO_T is smaller then the length in the file. Return of function dbm_restore_data
4053	The header file holds an other information for a length than in the segment itself
4054	Not enough memory for allocation on the PC
4055	No index for file handle in structure FLASH_DIR of RCS found
4056	
4057	File type 2 can not be printed because of too many definitions
4058	The definitions need too many lines to display them, than in the program available
4059	An unknown format for the parameter. Valid is U, H, or S

Number	Description
4060	Unknown parameter type
4061	The data base was transmitted into the FLASH
4062	Set 0 contains no structure definition
4063	Set 0 can not be deleted
4064	Error during execution of a ODBC data base access
4065	Initializing of DBM through RCS had no success
4066	Passed data length incorrect
4067	Sorting function not linked
4068	Error in function parameter
4069	Error from ODBC table
4070	No free handle available. Too many data base links are already opened
4071	Unknown data type found in the table
4072	Structure of table GLOBAL not correct or no such table existing
4073	No name of an ACCESS data base
4074	Download window can't be created
4075	Download not fully performable
4076	Parameter SourceType of table SourceTab not existing
4077	Parameter Translate of table CreateTab does not exists
4078	Parameter Sourcefile of table CreateTab does not exists
4079	Parameter Sourcetable of table CreateTab does not exists
4080	Parameter Desttable of table CreateTab does not exists
4081	Parameter Special of table CreateTab does not exists
4082	More than 32 tables shoul be created
4083	No entry in element szSourceFile
4084	ODBC connection initialization not possible. This could happen when in file ODBCINST.INI in section [Microsoft Access Driver (*.mdb)] is no valid path to ODBCJT16/32.DLL.
4085	Error in structure in the ACCESS data base that is in DBM format
4086	Error in structure in the ACCESS data base that is in DBM format
4087	No data in a ODBC table
4088	No entry
4089	ODBC set length not valid
4090	Not enough data sets in ODBC table
4091	Table CreateTab not found
4092	Error in structure of table CreateTab
4093	No entry in element szSourceTable
4094	No entry in element szDestTable
4095	Entry in iSourceType of table CreateTab is wrong
4096	Entry in iTranslate of table CreateTab is wrong
4097	Function SQLAllocStmt reports an error
4098	OdDBC source table not found
5001	Function PackLongToByteShort: Not enough space in pvD (Number of elements greater than reserved memory)
5002	Function PackLongToByteShort: Not enough space in pvD. Detected during converting of pvS
5003	Function StringToByte: Not enough space in pvD
5004	Function IntToByte: Not enough space in pvD
5005	Function LongToShort: Not enough space in pvD
5006	Function PackStringDumpToByteArray: Not enough space in pvD
5007	Function PackStringBumpToByteArray: A character was found, which is not convertable into a HEX value
5008	Function PackStringDumpToByteArray: Number of character odd

APPENDIX B – SAMPLE PMAC PLC TO TRANSFER 16-BIT INTEGER DATA

The variables defined to access the PMAC Gateway hardware are all 8-bit unsigned data types because the hardware on the PMAC Gateway is byte oriented. In many cases, individual bits of the fieldbus data representing discrete I/O may be dealt with, or bytes may be combined in order to represent data as 16-bit integer or floating point values.

M-Variables (16-bit) for Use in Programs

The memory address used for the following M-Variables are valid only for a Turbo PMAC2 in which a User Buffer has been created to allocate this memory. (Refer to the PMAC On-Line command section of the Software Reference manual.)

Example:

```
M6000->Y:$6C000,16,8                ;Low Byte of first output word
M6001->X:$6C000,16,8                ;High Byte of first output word
M6002->Y:$6C001,16,8                ;Low Byte of second output word
M6003->X:$6C001,16,8                ;High Byte of second output word
M6004->Y:$6C002,16,8                ;Low Byte of third output word
M6005->X:$6C002,16,8                ;High Byte of third output word
M6006->Y:$6C003,16,8                ;Low Byte of fourth output word
M6007->X:$6C003,16,8                ;High Byte of fourth output word

M6500->Y:$6C100,16,8                ;Low Byte of first input word
M6501->X:$6C100,16,8                ;High Byte of first input word
M6502->Y:$6C101,16,8                ;Low Byte of second input word
M6503->X:$6C101,16,8                ;High Byte of second input word
M6504->Y:$6C102,16,8                ;Low Byte of third input word
M6505->X:$6C102,16,8                ;High Byte of third input word
M6506->Y:$6C103,16,8                ;Low Byte of fourth input word
M6507->X:$6C103,16,8                ;High Byte of fourth input word
```

Allocate M-Variables for Receive Process (Input) Data

```
M3300->Y:$010700,0,16,u             ;Input Word1
M3301->Y:$010701,0,16,u             ;Input Word2
M3302->Y:$010702,0,16,u             ;Input Word3
M3303->Y:$010703,0,16,u             ;Input Word4
```

Allocate M-Variables for Send Process (Outputs) Data

```
M4300->Y:$010600,0,16,u             ;Output Word1
M4301->Y:$010601,0,16,u             ;Output Word2
M4302->Y:$010602,0,16,u             ;Output Word3
M4303->Y:$010603,0,16,u             ;Output Word4
```

Programming Example for Word Oriented Data

The conversion of 8-bit to 16-bit or 16-bit to 8-bit requires a program.

The following is an example of a PMAC compiled PLC that effectively sends or receives the application's 16-bit data to/from the bytes that are transferred to/from the fieldbus.

```
close
open plcc1 clear
M6000=M4300&$00FF
M6001=(M4300&$FF00)/256
M6002=M4301&$00FF
M6003=(M4301&$FF00)/256
M6004=M4302&$00FF
M6005=(M4302&$FF00)/256
M6006=M4303&$00FF
M6007=(M4303&$FF00)/256
M3300=M6500+(256)*M6501
M3301=M6502+(256)*M6503
M3302=M6504+(256)*M6505
M3303=M6506+(256)*M6507
Close
```

APPENDIX C – HILSCHER HYPERLINKS

System Configurator (Sycon) PROFIBUS:
http://www.hilscher.com/files_manuals/pb_oie9.pdf

System Configurator (Sycon) CANopen:
http://www.hilscher.com/files_manuals/co_oie8.pdf

System Configurator (Sycon) DeviceNet:
http://www.hilscher.com/files_manuals/dn_oie7.pdf

CC-Link Slave Protocol Manual (COMPRO configurator):
http://www.hilscher.com/files_manuals/ccs_pre.pdf

CC-Link Booklet (Hardware):
http://www.hilscher.com/files_manuals/CC-Link%20Booklet.pdf

Booklet DeviceNet (Hardware):
http://www.hilscher.com/files_manuals/DeviceNet%20Booklet.pdf

Profibus Booklet (Hardware):
http://www.22hilscher.com/files_manuals/PROFIBUS%20Booklet.pdf

CANOpen Booklet (Hardware):
http://www.hilscher.com/files_manuals/CANopen%20Booklet.pdf

Hilscher Manuals (For In-Depth Protocol Explanations and Memory Map – except CC-Link):
ftp://support.deltatau.com/DT-USA/Delta%20Tau%20Fieldbus/MANUALS/manuals.pdf