Product Description

The communication driver AL-2785 is an OPC Server used with Altus Programmable Logic Controllers. It allows the communication to supervision and process control software that are based on OPC Client standard.

The driver AL-2785 was developed to operate with data transmission on Ethernet network, using application protocol ALNET II over TCP/IP, always communicating with Programmable Logic Controllers.

Under this operation the master device manages the data transmission to send commands to slave device, which receives the task and transmit a corresponding answer. The driver also operates as master and slave on simultaneous way, allowing reception of unsolicited messages from Programmable Controllers.

The communication with Altus Programmable Controllers is established through a common Ethernet card installed on the computer.

Ordering Information

Included Items

The product packing comes with:

- CD with communication driver and technical characteristics
- Hardkey

Product Code

Use the following codes when ordering the product:

Code	Description
AL-2785	OPC ETH ALNET II Communication Driver

Related Products

Depending on your system requirements, the following products might be ordered separately.

Code	Description
AL-3405	Ethernet Interface
AL-3412	Ethernet Interface 10/100 Mbits
PO7091	Ethernet Interface to Ponto Series
PO9901	WebGate Plus

Characteristics

The communication driver AL-2785 is based on command transmission (send / receive) and the corresponding answers. The driver is responsible for the consistency of the data on the messages. Also it is responsible for operand actualizing that are configure on supervision software environment.

It presents the following main characteristics:

- Compatibility with OPC1.0 and 2.0 Server versions.
- Ethernet communication using ALNET II protocol over TCP/IP.
- It Interprets the following ALNET II commands:
  - Write / read simple operands (memory, auxiliary, real, integer, decimal, I/O).
  - Write / read bit operands (memory, auxiliary and I/O).
  - Write / read table operands (real, integer and decimal).
- It allows unsolicited messages.
- It allows redundant configuration without the use of scripts to control active and standby stations..
- Unlimited Clients connections.
- The hardkey allows the use of unlimited tags on supervision station. The driver can be run on demo mode, which allows the use of 100 tags during two hours.

The data transmission can use communication blocks up to 220 bytes. The driver automatically put together the data to take advantage of the block limit. If the data transmission exceeds the block limit, the driver automatically separated the block to fit the corresponding block size. If the Webgate Plus (PO9901) is connected the block limit must be changed for 128 bytes.

The maximum number of operands that can be read / write on each block are counted in the following table (AL-3405 and AL-3412 Ethernet interfaces)

Operand	Bytes by Operand	Maximum number of operands by block (AL-3405, AL-3412 and PO7091)	Maximum number of operands by block (Webgate Plus – PO9901)
I/O Octet	1 byte	220 operands	64 operands
Auxiliary	1 byte	220 operands	64 operands
Memory	2 bytes	110 operands	64 operands
Decimal, Real, Integer	4 bytes	55 operands	32 operands
Memory Table	2 bytes / position	110 positions	64 positions
Decimal, Real, Integer Table	4 bytes / position	55 positions	32 positions

Installation

To install and execute the driver AL-2785 it is necessary the following minimum requirements:

- Pentium III
- 128 MB RAM.
- 800 x 600 pixels resolution.
- 10 MB Free hard disk space (it doesn't included data files).
- USB or parallel port.
- Microsoft Windows NT, 2000 or XP.

Software Installation

To install the software the next steps must be executed:

- Connect the hardkey on USB or parallel port. If already exists another device installed on parallel port, connect the hardkey first, then connect the device on the hardkey. The OPC driver will validate the license through the hardkey device.
- Insert the installation CD and follow the instructions on the screen. The message "Installation Complete" it will appears if the installation procedures are successfully. The program group will be created on desktop.
- Now the driver AL-2785 is installed and ready to be executed as Windows service program.

Configuration

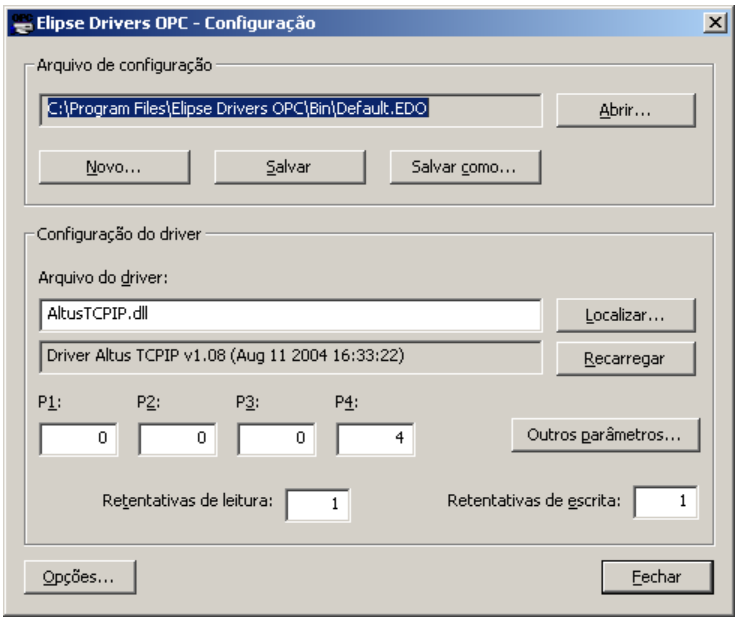
The OPC driver AL-2785 has the execution configured according the specifications on configuration file (extension .EDO). The software OPC Configuration Driver can edit this file.

General Configuration

The configuration of the driver begins with definition of the file that is actually active and file functions to open/save files that are described as following.

- [Opções...]: Load the configuration file. If another configuration file is already loaded, the system will verify if the user wants to change the actual configuration.
- [Novo…]: Generate a new configuration file. If another configuration file is already loaded, the system will verify if the user wants to change the actual configuration.
- [Salvar]: Save the actual configuration.
- [Salvar como …]: Save the actual configuration with another name.

The following picture shows the driver configuration screen:



The parameters P1, P2 and P3 must not be changed. They need to stay with zero value. The parameter P4 indicates the number of additional tasks that will be created to communicate with each Programmable Controller. During execution the driver learns the tags that the program is reading, executing the reading of the tags in each task. By this way the tag value it will be already available in the next reading solicited by the driver.

The retentive boxes (read / write) indicates the number of times that the driver will try to do write / read operation before indicates an error.

The button [Opções...] opens a dialog to define logs generation options.

- It generates diary logs files. Active the driver OPC activity register, creating a file according definition indicated on “Caminho” box
- It generates a detailed log file. Active the detailed log register, creating a file according definition indicated on “Caminho” box.

The button [Fechar] will close configuration.

Read-ahead Threads

The read-ahead threads can be enable by the P4 parameter. It will have the number of threads that the driver needs to create for each PLC (besides the main communication thread). If P4 = 5 the driver will create 6 connections with the PLC (1 main thread and more 5 read-ahead threads). If P4 = 0 the driver only will create 1 thread (main thread). This is usual way that the driver works.

It is very important to dimension the P4 parameter correctly. The number of connections can not be more than the capacity of the PLC to treat multiple requisitions. The typical value for P4 is 4.

The limits of P4 are 0 to 10, values that are not included in this range it will consider 10.

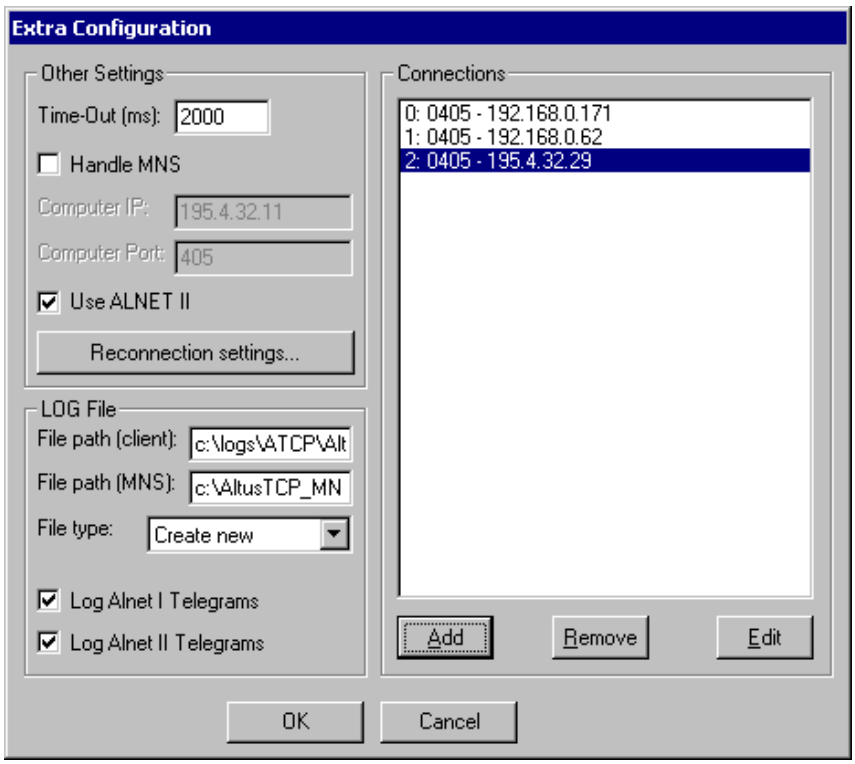
Unsolicited Messages

The use of unsolicited messages increases the performance of the supervision program, because it is not necessary a cyclic scan of the PLC variables, even when the variables didn’t change the values.

Every time that the status of some variable changes, the PLC will send a warning message to the driver, so it can refresh (change) its database.

Extra Configuration

Other parameters from driver OPC can be configure selecting “Outros parâmetros...” or “Extra”. The next picture shows the extra configuration screen.

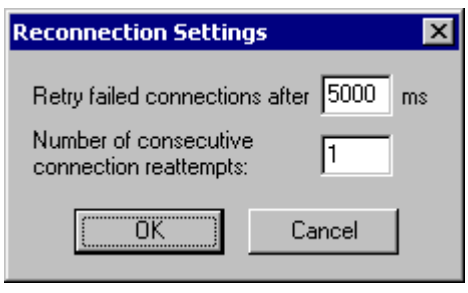


The options can be separated in three groups, according next sessions.

Other Settings Options

Field	Description
Time-out	It defines the time (milliseconds) that the driver waits an answer from PLC after a requisition from the driver.
Handle	It enables unsolicited messages.
Computer IP	Computer IP address. **If the unsolicited messages are enable this parameter is not used.**
Computer Port	Computer IP port. **If the unsolicited messages are enable this parameter is not used.**
Use ALNET II	In some cases it is necessary to communicate through ALNET I protocol via TCP/IP, so this option must be disable. The usual architectures use the ALNET II protocol via TCP/IP.

The button *Reconnection Settings* shows the following window.



Field	Description
Retry failed connections after	It defines the time that the driver will try to reconnect the connection.
Number of consecutive connection reattempts	It defines the number of consecutive connection reattempts. This option will configure the number of read / write operations (tags) that will reconnect in case of disconnection. In case of reconnection failure for each operation, an error will be send after the configured timeout. After the number of reattemps, any new tag operation will send an immediately error. The reconnection will begin again only after the configured time. If configured time is reached the reattemps will start again.

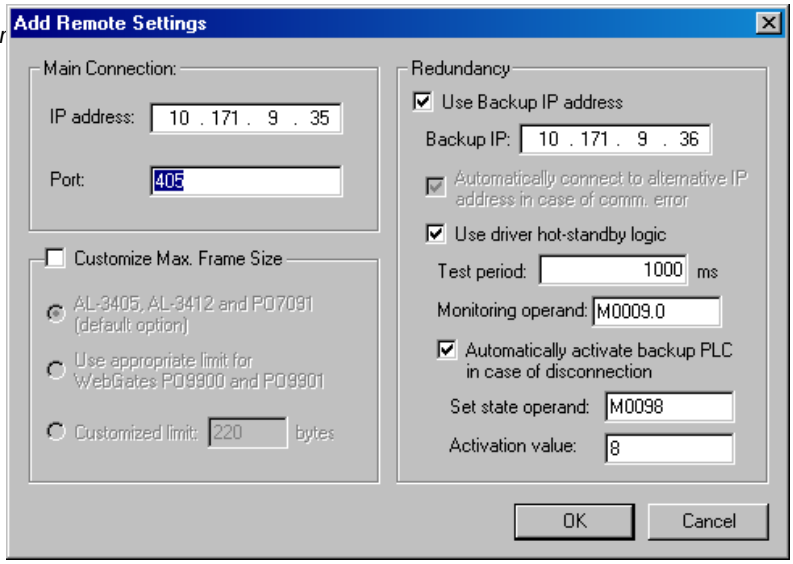
LOG File options

Field	Description
File path (client)	It defines the Log filename where PLCs communications (configured on PLCs list) are saved. It will create a new file for each communication thread. The configured filename indicates the main thread. The read-ahead threads will create a new file with the same name but with underscore and the thread order number, starting by 1. Every threads of the same order use the same filename.
File path	It defines the log filename for unsolicited messages.
File type	It defines the log mode. The option **No LOG** doesn't use a log file. The option **Create new** opens a new file each time the driver is started. The option **Append data** uses the same log file to append information.
Log ALNET I Telegrams	It writes on log filename the ALNET I telegrams.
Log ALNET II Telegrams	It writes on log filename the ALNET II telegrams.

Connections Options

Field	Description
Add	It adds a new PLC connection with corresponding port and IP address. This new PLC is added on PLC list and its connection number is showed in front of the port an IP address. If a backup IP address is defined, it will be showed after the main IP, separated by comma. If the option **automatically IP change** is enable the number 1 is added after backup IP, separated by comma.
Edit	It allows the parameter edition for PLC connection.
Remove	It removes the select connection on connection list.

The button *Add Rer*



Field	Description
Port	It defines PLC IP port (usual 405).
Main IP	It defines Main PLC IP port.
Use Backup IP Address	When this option is enable it is possible to specify a secondary IP (redundant PLC). If the option is disable the previously IP configuration is lost.
Automatically Change IP Address	When this option is enable the driver will try to connect with different IP address. In case of communication failure with main IP address.
Backup IP	When the option **Use Backup IP Address** is selected the PLC redundant IP address is configure in this option. The redundant PLC must to accept connection with the same IP address that the main PLC.
Use Driver Hot-Standby Logic	When this option is enable the driver will automatically manage the redundancy process (hot stand-by) between PLCs. The option **Automatically Change IP Address** must be enable to correct operation of this option.
Test Period	It defines the period to monitor an operand that will inform if the PLC is active (monitoring operand).
Monitoring Operand	In this option must be add the PLC monitoring operand. The operand will inform if the PLC is active. It will have the value 1 to active, or zero for inactive. The default value to AL-2007 is M009.0.
Automatically Activate Backup PLC in Case of Disconnection	When this option is enable the driver will active the backup PLC if the main PLC is disconnected. The driver will write a configurable value on a configurable operand to active the backup PLC.
Set State Operand	This option will active the PLC activation operand (if it exists). The configured operand will receive a configurable value to active the backup PLC. The default value to AL-2007 is M0098.4.
Activation Value	This value will be write on the **Set State Operand** (activation operand) to active the backup PLC. The default value to AL-2007 is 1.
Customize Max Frame Size	It configures the maximum number of bytes for write and read operands. It must br configured according the interface model installed on the PLC.
AL-3405, AL3412 e PO7091	It configures the maximum frame size according the selected module (AL-3405, AL-3412 and PO7091). The maximum size is 220 bytes.
WebGate PO9901 e PO9900	When select it configures the maximum frame for WebGate PO9901. The maximum size is 128 bytes. **ATTENTION: If octets blocks and auxiliary blocks are used for read / write operations, the user must to be careful to form blocks less than 64 operands (64 bytes). The blocks are form by the driver automatically based on *Max Frame Size*. In this case the option *Customize Limit must be configure with the value* 64.**
Customize Limit	It configures a specific value for maximum frame size.

Tags Addressing

The tags for acquisition and writing are configured by mnemonics related in the following table. The mnemonic defines the tags addressing.

Mnemonics	Description	*Read/Write*
<con:>Ax	Auxiliary	R/W
<con:>Ax.b	Auxiliary bit	R/W
<con:>Ax_n	Auxiliary block	R/W
<con:>Dx	Decimal	R/W
<con:>Dx.b	Decimal bit	R/W (not recommended)
<con:>Dx_n	Decimals block	R/W
<con:>Ex	Input	R
<con:>Ex.b	Input bit	R
<con:>Ex_n	Input block	R
<con:>Fx	Real (float)	R/W
<con:>Fx_n	Real (float) block	R/W
<con:>Ix	32 Bits integer	R/W
<con:>Ix.b	32 Bits integer bit	R/W (not recommended)
<con:>Ix_n	32 Bits integer block	R/W
<con:>Mx	Memory	R/W
<con:>Mx.b	Memory bit	R/W
<con:>Mx_n	Memory block	R/W
<con:>Sx	Output	R/W
<con:>Sx.b	Output bit	R/W
<con:>Sx_n	Output block	R/W
IPcp:TDUMx.y_n	Unsolicited messages decimal table	R
<con:>TDx.y	Position of decimal table	R/W
<con:>TDx.y_n	Decimal table	R/W
IPcp:TFUMx.y_n	Unsolicited messages real (float) table	R
<con:>TFx.y	Position of real (float) table	R/W
<con:>TFx.y_n	Real (float) table	R/W
<con:>TIx.y	Position of 32 bits integer table	R/W
<con:>TIx.y_n	32 Bits integer table	R/W
IPcp:TMUMx.y_n	Unsolicited messages not solicited messages	R
<con:>TMx.y	Unsolicited messages	R/W
<con:>TMx.y_n	Memory table	R/W
<con:>BSx_n	I/O bus status	R
<con:>CSx	Communication status	R
<con:>ES	Equipment status	R

NOTES:

- **<con:>** It is an optional prefix that defines the connection number according PLC list (Connections group on Extre Configuration window). If this prefix is not inform the value will be 0.
- **x** Represent the operand address or table number, according solicited type.
- **y** Represent the initial position of the table.
- **n** Represent the number of items to be read.
- **b** Represent the bit number, starting from 0 (less significant bit) to 31 (more significant bit), the number it will depends of the data type.
- **IPcp** Represent the last number from PLC IP, only used with unsolicited messages. For example, a PLC with IP address 195.4.32.29 and operand %TM009 position 50, the mnemonic it will be IP29;TMUM009.050.

Mnemonic	Description
A20	Auxiliary 20 (connection 0)
1:M2400	Memory 2400 (connection 1)
D10_4	Decimal block 10 with 4 elements (connection 0)
E5.2	Bit 2 from input 5 (connection 0)
TM17.0_20	21 positions from memory table 17 starting position 0 (connection 0)
IP29:TFUM3.1_30	30 positions from decimal table 3 (unsolicited messages) starting position 1 PLC with IP 29 (end).
1:M2400	Memory 2400 (connection 1)

NOTES:

- The R/W allows read / write block operations. The types mark with R or W allows only read or write operations.
- The operation to write a bit on %D and %I operand it is strongly no recommended. This option was keep only for version compatibility with older driver versions. This operation reads the value from an operand and overwrites with the new value. If the value change on PLC during this procedure, the write of the new value will overwrite the PLC value.
- The driver allows block writing with any size. The block will be divided automatically, if the size is exceeds the configured limit (according each Ethernet Interface). However, this limit can be change according the Ethernet Interface used for communication (Webgate Plus PO9901). The technical characteristics of each Interface must be consult for maximum block limit.

Equipment Status Reading

The ES mnemonic command gets from PLC the status of the equipment into a block with 64 bytes, according the following table.

Byte	Size	Description
00	1	CPU model
01	1	Executive version
02	1	Operation mode 1
03	1	Message code 1
04	2	Free user RAM area 2
06	2	Free user RAM area 1
08	2	RAM Status from application program 1
10	2	Instantaneous cycle scan time
12	2	Medium cycle scan time
14	2	Maximum cycle scan time
16	2	Minimum cycle scan time
18	1	Module E018 calling period time
19	1	Module E019 calling period time
20	1	Reserved
21	1	Maximum cycle scan time for program execution
22	1	RAM Status from application program 2
23	1	Operation mode 2
24	2	Free program RAM area 8
26	2	Free user RAM area 7
28	2	Free user RAM area 6
30	2	Free user RAM area 5
32	2	Free user RAM area 4
34	2	Free user RAM area 3
36	1	Program EPROM status
37	2	Free program EPROM area 8
39	2	Free program EPROM area 7
41	2	Free program EPROM area 6
43	2	Free program EPROM area 5
45	2	Free program EPROM area 4
47	2	Free program EPROM area 3
49	2	Free program EPROM area 2
51	2	Free program EPROM area 1
53	1	Message code 2
54	1	Message code 3
55	1	Message code 4
56	8	8 Characters string with secondary identification from product (ASCII)

Observations:

- Executive version is formatted in V.RC. V is the version number, R the revision number and C the last correction number.

- PLC Mode operation 1

Bit	7	6	5	4	3	2	1	0
Data	Exe	Prg	Cic	Tst	Cop	For	Cpt	Sai

Exe PLC on execution mode
Prg PLC on programming mode
Cic PLC on cycle mode

Tst	PLC on test mode
Cop	Module copy from EPROM to RAM
For	Relay forced command
Cpt	RAM Compacting
Sai	Digital outputs disable

- PLC Mode operation 2:

Bit	7	6	5	4	3	2	1	0
Data							Apg	Prt

Apg	EPROM Erasing
Prt	PLC protection level 0 (no protection) to 3 (maximum protection)

- RAM Status and EPROM status. The data informs the zipped and active areas from RAM and EPROM:

Bit	7	6	5	4	3	2	1	0
Data	Bc3	Bc2	Bc1	Bc0	B3	B2	B1	B0

Bits 3-0: Active areas
Bits 7-4: Zip areas (just RAM)

I/O Bus Status Reading

The BSx n mnemonic command gets the status bus indicated on “x” field. The “n” field indicates the block size to be read, according the following expression: 4 + 2 x number of possible modules on bus. The byte 03 informs the number of modules connected in the bus. The format of the block is indicated according the following table.

Byte	Size	Description
00	1	Maximum number of I/O bus to connect to PLC.
01	1	Bus type: =0 AL-1000 bus =1 AL-3000 bus
02	1	Bus status: =000 Unexist =016 Error =064 Disable to change =128 Usual operation
03	1	Number of I/O connected on bus.
The next positions each module uses 2 bytes, indicating the module type and its status. The “i” indicates the module position on the rack from 0 to 15.		
04 + i * 2	1	I/O module type model.
05 + i * 2	1	I/O Module status: =000 Unexist =016 Error =064 Disable to change =128 Usual operation, actualization

Communication Status Reading

The CSx mnemonic command gets from PLC the communication status statistics from ALNET II port. When the value of field "x" is 1 the statistics will be reset or will keep the same value when 0.

Byte	Size	Description
Statistics from data transmission		
0	2	Number of transmissions without errors
2	2	Number of transmissions with collision errors
4	2	Number of transmissions with underrun errors
6	2	Number of transmissions without ACK reception
8	2	Number of transmissions canceled by reattempps
10	2	Number of package time-outs
12	2	Number of empty buffer to transmit
14	4	Reserved
Statistics from received data		
18	2	Number of receptions without errors
20	2	Number of receptions with collision errors
22	2	Number of receptions with overrun errors
24	2	Number of receptions with CRC errors
26	2	Number of receptions with align errors
28	2	Number of receptions with size errors
30	2	Number of service time-outs
32	2	Number of empty buffer to receive
34	2	Reserved
ALNET II parameters from net (each node)		
36	2	Node communication speed
38	2	Node address
40	2	Subnet address
42	2	Node multi-cast group
44	4	Reserved
48	2	Internal bus time-out
50	2	Internal bus time-out
52	2	Internal bus time-out
54	2	Maximum number of transmission reattempps
56	20	Node identification name from ALNET II (ASCII)

Byte	Size	Description
Information from physical connection from ALNET II node:		
76	2	Physical connection =0 Electrical =1 Optical
78	2	Redundancy physical connection =0 Yes =1 No
80	2	Period to send messages to redundancy test (seconds)
82	2	Period to wait physical commutation in failure case (seconds)
84	4	Reserved
86	2	Active connection =1 Connection 1 =2 Connection 2
88	2	Status on physical connection 1 =0 Ok =1 Failure
90	2	Status on physical connection 2 =0 Ok =1 Failure
92	2	Reserved
94	2	Forced physical connection =0 No forced =1 Connection 1 forced =2 Connection 2 forced
96	2	Forced status on physical connection 1 =0 Ok =1 Failure
98	2	Forced status on physical connection 2 =0 Ok =1 Failure

Performance

The driver OPC Server AL-2785 allows configuration of unlimited tags, when the hardkey is installed.

However, the performance chance according the number of configured tags, type of data and and configuration selected.

The next table shows the time to actualize 2000 operands %M. The test includes Altus Ethernet Interfaces, changing the number of simultaneous connections on the driver.

Interface	CPU	P4 = 0 e LAI = 0	P4 = 4 e LAI = 4	P4 = 8 e LAI = 8
PO7091	PO3342	1.242 ms	1.025 ms	No recommended
AL-3405	AL-2004	1.801 ms	444 ms	No recommended
AL-3412	AL-2004	1.063 ms	291 ms	164 ms

The test with the CPUs was realized with pre-established cycles of 50ms.

Redundant PLCs

In case of redundant architectures both PLCs (main and backup) are connected by the AL-2007 interface. This module will manage the redundancy operation. It uses the hot-standby mechanism that keeps the application program working only in 1 PLC (active) and in case of failure the other one will assume the active position. When the PLC is running the program the status is defined active status, in other hand the status of the stand-by PLC is define as backup status

The AL-2785 is projected to communicate with redundant PLCs that use the AL-2007 interface. The next table indicates the options to configure the redundant PLC.

Field	Configuration
Use Backup IP Address	Enable
Backup IP	Configure second PLC IP
Use Driver Hot-Standby Logic	Enable
Test Period	Recommended: 1000
Monitoring Operand	M0009.0 (AL-2007)

Also it is possible to configure the switch of the PLC status when the driver lose the communication with active PLC. This mechanism only can be use by the driver AL-2785. Architectures that use more than one driver it can generate communication problems. The driver cans communicate with the Backup PLC and other one communicates with acute PLC. If it happens the driver that communicate with stand-by PLC will change its status for active, then the other driver will do the same function. This situation will start a switching between backup and active PLCs. If it is necessary to configure this situation the following fields must be use.

Field	Configuration
Automatically Activate Backup PLC in Case of Disconnection	Enable
Set State Operand	M0098.0 (AL-2007)
Activation Value	1 (AL-2007)

Manuals

The documents integrated on the product must be consult (*help on line*).