UNIVERSIDAD DE OVIEDO

ESCUELA POLITÉCNICA DE INGENIERÍA DE GIJÓN

MÁSTER EN INGENIERÍA INFORMÁTICA

TRABAJO FIN DE MÁSTER

SISTEMA DE INSPECCIÓN DE CARRILES: CONFIGURACIÓN Y CÁLCULO DIMENSIONAL

PEDRO MANSO BERNAL

JULIO 2014

UNIVERSIDAD DE OVIEDO

ESCUELA POLITÉCNICA DE INGENIERÍA DE GIJÓN

MÁSTER EN INGENIERÍA INFORMÁTICA

TRABAJO FIN DE MÁSTER

SISTEMA DE INSPECCIÓN DE CARRILES: CONFIGURACIÓN Y CÁLCULO DIMENSIONAL

ANEXO D

COMUNICACIÓN CON EL PA

PEDRO MANSO BERNAL

JULIO 2014

ÁREA DE ARQUITECTURA Y TECNOLOGÍA DE COMPUTADORES

TUTOR: DANIEL F. GARCÍA MARTÍNEZ

Process Automation Communication Interface

Document:	**Specification**
Version:	2.0
Date:	14/07/2014
Created by:	ArcelorMittal – Process Automation Department
	ATC-UniOvi
Contact to:	Vanessa Román Leira
	Vanesa.Roman@arcelormittal.com
	Daniel F. García
	dfgarcia@uniovi.es
Status:	<**preliminary**/definite>

Version	Comments
1.0	General specifications
2.0	

1   Overview

This document describes the necessities of TCP/IP communication between Automation Process Computer (PA) and Inspection Machine Vision System (MV).

2   Communications

Ethernet TCP/IP connection over Local Area Network (LAN).

In order to keep format of general communications protocol in our host, we propose MV has the client function and PA has the server function.

All data to exchange will be defined as telegrams.

Host	Function	IP Address	Port
Process Automation	Server	To be defined	Defined by PA
Machine Vision	Client	To be defined	Not necessary

In following items of this document we describe data needed to exchange information.

3   Check of connection status and message transfer

3.1   Check message validity

In order to detect the correct start and end of the data stream, the receiver will have to check on the message header and end flags.

In case one of this flags cannot be found considering the message ID, message length, etc, the receiver must restart communication with the sender.

Restart communication will be done by disconnecting and reconnecting the socket.

3.2   Series value

The sender increments the series value by 1 for each message sent (excluding life message).

The series value will be reset to 0 after reaching 9999.

This value could be used as help in commissioning to detect missing messages.

4   Messages

4.1   Data check

The data receiver will not check the validity of the data received. The sender will be responsible of the correct format of the data sent.

4.2   Data format

Message telegrams will be transmitted as ASCII strings.

Numbers

- "0" left fill

Example: Five character value 321 → "00321", -321 → "-0321"

- Decimal separator "."
- Missing or unknown values filled with "0"

Strings

- space code right fill

Example: Five character string PLC → "PLC "

- the strings are not terminated by "\0"
- Missing or unknown values filled with spaces

5 Message structure

In order to keep general format of communications in our host, we propose the following message structure:

5.1 General structure

Each message contains:

- a header of constant length
- data that can vary depending on message ID
  - o for the same message ID the length of data will be constant
  - o unused values will be filled in with reset values (numbers "0", strings space code)
- an end of constant length

Header
Data […]
End
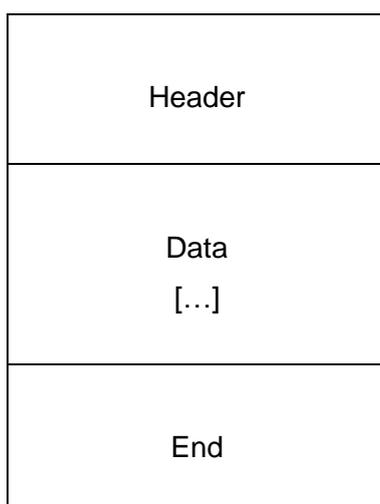
5.2 Message fields description

- Nº

  Reference to the field for documentation purposes

- Field Name

  Identifies the field

- Field Description

  Field explanation

- Field Format

  All fields are ASCII. Numbers will be extracted from the characters as needed.

  String value (A), Numeric Value (N)

  Format is followed by size of the data in number

- Unit

  Mm, kg, ºC, etc

- Comments

  Any comments or description of possible values of the field.

5.3 Message header

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Start_flag	Message start identifier	A6		"Start0", fixed value
2	Message_length	Indicates the whole length of the message	N8	Byte	Length of Data
3	Date	Date of sending message	A8	YYYYMMDD	
4	Time	Time of sending message	A6	HHMMSS	
5	Series_Value	Unique incrementing value for all messages	N4		0-9999
6	Message_ID	Message identification	A2		
7	Reserved	Reserved for future	A60		

The fixed length of the header is 90 bytes.

5.4 Message end

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS

1	End_flag	Indicates the end of the message	A2		"\0"

6 List of messages

MESSAGE ID	DESCRIPTION	SENDER	RECEIVER
10	Life message	PA	MV
20	Confirmation Life message	MV	PA
11	New rail data	PA	MV
21	Confirmation of new rail data received	MV	PA
22	Last rail measurement results	MV	PA
12	Confirmation of reception of last rail measurement results	PA	MV
13	Request one rail measurement results	PA	MV
23	One rail measurement results	MV	PA
24	MV status	MV	PA

7 Data exchange protocol

<u>Life message</u>

Starting from the last communications reset, PA sends a life message to MV every 60 seconds. If MV does not receive a life message after 120 seconds, MV has to restart communications with PA.

After receiving life message from PA, the MV sends a confirmation of life message back to PA. In case PA does not receive a life message from VM after 120 seconds, it has to restart communications with MV.

<u>Data sending from PA to MV</u>.

- All data describing the rail will be sent before the rail enters into the MV (after last results are received), time enough in advance to the MV to be prepared.
- Data to send are defined in following sections of this documentation.
- MV will send to the PA a confirmation of data received.

<u>Inspection process</u>.

- New rail enters to the Inspection System. PA sends all data from the rail to the MV.
- Inspection results are sent from MV to PA.

<u>Repeat result data</u>

- In case of communication lost between PA and MV, MV may be inspecting anyway. In order to let PA to load inspection result data afterwards, a message of request one rail measurement is sent from PA to MV.

8 Life message

Direction	PA → MV
Message ID	10
Sending	Every 60 Seconds.

9 Confirm Life message

Direction	MV → PA
Message ID	20
Sending	Sent after life message has been received.

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Status	Status ID of the MV: See Table 1	N3		
2	Description	Status ID of the MV: See Table 1	A40		

10 New rail data

For each new rail entering to the MV, the next data are sent from PA to MV:

Direction	PA → MV
Message ID	11
Sending	Before new rail enters the gauge and after results of predeceasing rail received by PA

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Serial_Number	Identification of rail	A10		Example: N680873561
2	Rail_Type	Identification of rail type	A20		Example: CAR60E
3	Tolerance_Std	Identification of tolerance	A20		Example:

		standard			CVD7A73
4	Reserved	Reserved for future	A 60		

10.1 About tolerance standard

@ @ Hay que definir un tamaño

IMPORTANTE: ACTUALMENTE EL CONFIGURADOR NO ADMITE ESPACIOS. HAY QUE USAR GUIÓN BAJO. TAMPOCO ADMITE QUE LOS NOMBRES EMPIECEN POR NÚMERO.

Por ejemplo la norma europea denominada "UNE-EN 13674-1" de 14 caracteres con espacio en medio. Otra son, AREMA, GOST, etc.

ArcelorMittal tiene que definir como serán y de donde los obtiene el Ordenador de Proceso

11 Confirmation of new rail data received

After new rail data sent from PA to MV, a confirmation of data received is needed.

Direction	MV → PA
Message ID	21
Sending	After MM receives new rail order data from PA

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Rail_Serial_Number	Identification of rail	A10		Copy of new rail data Example: N680873561
3	Reserved	Reserved for future	A50		

12 Last rail measurement results

After inspection, results data must be collected by PA.

Direction	MV → PA
Message ID	22
Sending	After MV has measured and evaluated

	the whole rail

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Rail_Serial_Number	Identification of rail	A10		
2	Rail_Data	Measured rail data	A??		Variable length

13 Confirmation of reception of last rail measurement results

After last rail measurement results are received by PA, a confirmation of reception is sent to MV.

Direction	PA → MV
Message ID	12
Sending	After PA has received the measurement results

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Rail_Serial_Number	Identification of rail	A10		Copy of new rail data Example: N680873561
3	Reserved	Reserved for future	A50		

14 Request one rail measurement results

The PA can request the measurement results of any rail already inspected.

Direction	PA → MV
Message ID	13
Sending	At any time after a rail has been inspected.

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Serial_Number	Identification of rail	A10		Example: N680873561
2	Reserved	Reserved for future	A 60		

After MV has received this order message, results are sent to PA.

15 One rail measurement results

After MV receives a request of one rail data, the measurement results are sent to PA.

Direction	MV → PA
Message ID	23
Sending	After MV has measured and evaluated the whole rail

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Rail_Serial_Number	Identification of rail	A10		
2	Rail_Data	Measured rail data	A??		Variable length

16 System status

Direction	MV → PA
Message ID	29
Sending	After the status of the system changed

If the system status changes, a message will be send to the PA.

After new connection established between PA and MV status should be sent.

N	NAME	DESCRIPTION	FORMAT	UNIT	COMMENTS
1	Status code	Status ID of the VM: See Table 1	N3		
2	Status name	See Table 1	A40		

Status code	Status Name	Description
0	SYS_ERR_UNKNOWN	Unknown system error.
1	SYS_OK	It is all OK.
2	SYS_IDLE	The system is idle.
3	SYS_BUSY	The system is busy.
4	SYS_ERROR	The system is in an error state.
101	CFG_ERR_UNKNOWN_PRODUCT_TYPE	An unknown product type was received. Warning that should be manager by operator.
103	CFG_ERR_PRODUCT_AT_DEVICE	New rail data could not be read because a rail is in the gauge
200	RES_OK	Inspected and result available Just information, no necessary to wait for this status to send new bar order data.
201	RES_ERR_NOT_INSPECTED	Rail not inspected.
300	NIS_OK	Ready for next pass.
301	NIS_ERR_PRODUCT_AT_DEVICE	There is still a rail in the device. If new bar order data is sent while inspecting, this status code will be received.
302	NIS_ERR_DUPLICATE_ID	The serial number has been already assigned. If two bar order data with the same serial id is sent, this status code will be received.
304	NIS_ERR_DB	Unexpected behaviour of the database server.
305	NIS_ERR_INSERT_PRODUCT	The new rail could not be added to the database.
306	NIS_ERR_UPDATE_SYSSTATE	The system state could not be updated.

Table 1: Status codes, names and description