CiA Draft Standard Proposal 414

Device Profiles for Weaving Machines

Part 1: General definitions

This is a draft standard proposal and not suitable to be implemented

Version 1.0
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HISTORY

Date	Changes
20/09/2001	• First public release

CONTENTS

1 Scope

The CANopen device profiles for weaving machines includes several parts:

- Part 1 describes general definitions
- Part 2 defines the device profile for feeders
- Part 3 defines the device profile for Jacquards
- Part 4 defines the device profile for dobbys
- Part 5 defines the device profile for loom controller

Devices compliant to these profiles use communication techniques, which conforms to those described in the CANopen communication profile (CiA Draft Standard DS-301). In addition, weaving machine devices and sub-systems may use communication techniques, which conform to those described in the framework for programmable CANopen Devices (CiA Draft Standard Proposal DSP-302). These specifications should be consulted in parallel to these device profile specifications.

2 Normative references

/1/: ISO 11898, Road vehicles – Interchange of digital information – Controller area network (CAN), November 1993.

/2/: CiA DS-301 V4.01, CANopen application layer and communication profile, June 2000.

/3/ CiA DRP-303-2 V1.1, Representation of SI Units and Prefixes, January 2000.

/4/ CiA DSP-302 V3.0, Framework for programmable CANopen devices, June 2000

3 Acronyms and abbreviations

CAN

Controller Area Network. Data link layer protocol for serial communication as specified in ISO 11898-1 (1999).

COB

Communication Object, which is made of one or more CAN frames. Any information transmitted via CANopen has to be mapped into COBs.

COB-ID

COB-Identifier. Identifies a COB uniquely in a CAN network. The identifier determines the priority of that COB in the data link layer, too.

SDO

Service Data Object. Peer-to-peer communication with access to the Object Dictionary of a CANopen device.

RPDO

Receive Process Data Object. Communication object of a device, which contains output data.

SDO

Service Data Object. Peer-to-peer communication with access to the Object Dictionary of a CANopen device.

TPDO

Transmit Process Data Object. Communication object of a device, which contains input data.

4 Definitions and operating principles

4.1 General definitions

CANopen networks may not only be used for embedded communication in weaving machines but also to integrate weaving machine sub-systems.

4.2 Weaving machine definitions

In weaving machines, CANopen networks are used to integrate feeder, Jacquard and other sub-systems to the loom controller. The sub-system communication interface is compliant to CANopen application layer and communication profile. The interface is specified in device profiles, which define the application objects as well as the default PDO communication and mapping parameter.

4.2.1 Feeder sub-systems

Regarding the feeder sub-systems there are several architectures supported by the device profile for feeders. Each feeder may be connected directly via CANopen network to the loom system or it is linked to a multi-feeder control unit. Optionally the multi-feeder control unit uses an additional embedded CANopen network to link the individual feeder devices. The device profile for feeders supports all these system architectures.
There are two main categories of feeders:

- Feeders for weaving machines with fluid insertion of the yarn (these machines can be air jet weaving machines or water jet weaving machines). They will be referred to as ‘pre-measuring feeders’.
- Feeders for weaving machines with mechanical insertion of the yarn (these machines can be: rapier weaving machines, projectile weaving machines, and others). They will be referred as ‘weft feeders’.

The main difference between these two categories is that on fluid jet machines the length of yarn to be inserted in the current insertion (also called ‘pick’) is determined by the feeder itself while on mechanical machines the length of the insertion is mechanically determined by the weaving machine.
On the pre-measuring feeders these means must be always present:

- A mechanical mean to release the yarn and to stop it. This mean is normally called ‘pin’.
- A sensor mean (typically a photocell) to detect the passage of each winding which leaves the feeder storage. By using this information feeder can command the pin in order to block the yarn passage and insert exactly the programmed number of windings.
- A mean to adjust the diameter of windings wound on the feeder spool body. By adjusting the diameter together with the number of windings for each pick it is possible to release the exact length of yarn that matches the height textile.
- A synchronized signal to indicate to the feeder, when open the pin in order to start the insertion. This signal must be synchronized with the starting of the main nozzle blow, which injects the air or the water together with the yarn.

On the weft feeders, instead, there must be means only to control and/or detect the right reserve storage on the spool body. These means can be of various types: photocell-based, piezoelectric based, mechanical feeler, etc. and they could vary a lot depending on feeders manufactures.
Typical accessories used on feeders (in general) are:

- means to adjust or vary the weft tension. These means which are commonly
- called ‘brakes’ can be mechanical only or electronically driven
- sensors to detect the absence of the yarn at the input side of the feeder

These sensors are useful for stop the machine before the weft reserve is fully emptied. It can be used also in conjunction with the automatic color selection (installed on the weaving machine) for reducing the loom stops in case of yarn breakage.

4.2.2 Jacquard sub-systems

To be defined

4.2.3 Dobby sub-systems

To be defined

4.2.4 Loom controller

To be defined

5 Error handling

5.1 Principle

Emergency Messages shall be triggered by internal errors in the device and they are assigned the highest possible priority to ensure that they get access to the bus without latency. By default, the Emergency Messages shall contain the error field with pre-defined error numbers and additional information.

5.2 Error behavior

If a severe device failure is detected the module shall enter by default autonomously the pre-operational state. If object 1029h is implemented, the device can be configured to enter alternatively the stopped state or remain in the current state in case of a device failure. Device failures shall include the following communication errors:

- Bus-off conditions of the CAN interface
- Life guarding event with the state ‘occurred’
- Heartbeat event with state ‘occurred’

Severe device errors also can be caused by device internal failures.

5.3 Additional error code meanings

Devices compliant to these profile specifications may use the following error codes:

Error Code	Meaning
FF10h	Feeder error

6 Predefinitions

6.1 Predefined communication objects

6.1.1 Object 1000h: Device Type

The object at index 1000h describes the type of device and its functionality. For multiple device modules the Additional Information parameter shall contain FFFFh. In this case, the object 67FFh shall be implemented.

Additional Information		General Information
Specific functions	Device class	Device Profile Number
31 24	23 16	15 8 7 0
MSB		LSB

General Information:

Device Profile Number: 414d

Device class:

Code	Function
0h	reserved
1h	Feeder
2h	Jacquard
3h	Dobby
4h	Loom controller
5h to FEh	reserved

Specific functions for feeder:

Code	Function
0h	reserved
1h	Single feeder
2h	Feeder control box
3h .. FEh	reserved

Specific functions for Jacquard:

Code	Function
0h	reserved
1h	To be defined
2h	To be defined
3h .. FEh	reserved

Specific functions for dobby:

Code	Function
0h	reserved
1h	To be defined
2h	To be defined
3h .. FEh	reserved

Specific functions for loom controller:

Code	Function
0h	reserved
1h	To be defined
2h	To be defined
3h .. FEh	reserved

6.1.2 Object 1001h: Error Register

The device-specific bit in the error register object is used to indicate a loom stop requirement. The following coding shall apply:
0 = no loom stop is required
1 = loom stop is required

6.1.3 Object 1029h: Error Behavior

This object specifies to which state the device shall be set, when a communication error or a device-internal error is detected.

0 = pre-operational (only if current state is operational)

1 = no state change

2 = stopped

Object Description

INDEX	1029h
Name	error_behavior
Object Code	Array
Data Type	Unsigned8
Category	Optional

Entry Description

Sub-Index	0h
Description	number_of_error_classes
Access	ro
Entry Category	Mandatory
PDO Mapping	No
Value Range	1h to 2h
Default Value	No

Sub-Index	1h
Description	communication_error
Access	rw
Entry Category	Mandatory
PDO Mapping	No
Value Range	0h to 2h
Default Value	0h

Sub-Index	2h
Description	internal_device_error
Access	rw
Entry Category	Mandatory
PDO Mapping	No
Value Range	0h to 2h
Default Value	0h

6.1.4 Object 67FF: Device Type

This objects shall describe the first virtual device in a multiple device module according to /2/.