

TECHNICAL REPORT



**Dynamic Modules –
Part 6-11: Design guidelines – Software and hardware interface for optical
multicast switches**

IECNORM.COM : Click to view the full PDF of IEC TR 62343-6-11:2019



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IECNORM.COM : Click to view the full PDF IEC 60384-36-11:2019

TECHNICAL REPORT



**Dynamic Modules –
Part 6-11: Design guidelines – Software and hardware interface for optical
multicast switches**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.01

ISBN 978-2-8322-7526-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms, definitions and abbreviated terms	6
3.1 Terms and definitions.....	6
3.2 Abbreviated terms.....	6
4 Survey results	7
4.1 Survey contents	7
4.2 Survey conditions	7
4.3 The analysis of responses	7
4.4 Future direction.....	9
Annex A (informative) Hardware and software interfaces	10
A.1 Hardware interfaces.....	10
A.1.1 Electrical connector	10
A.1.2 Pin assignment and functions	10
A.2 Software interfaces	13
A.2.1 General	13
A.2.2 UART communication	13
A.2.3 I ² C communication	13
A.2.4 Command sets.....	14
A.2.5 Reset.....	14
A.2.6 Alarm.....	15
Bibliography.....	16
Figure A.1 – Connector appearance.....	10
Table 1 – Analyzed results of software and hardware interface	7
Table 2 – Analyzed results of communication formats.....	8
Table A.1 – Connector form	10
Table A.2 – Pin assignment	11
Table A.3 – Explanation of functions	12
Table A.4 – Power supply voltage range	13
Table A.5 – Logical pin voltage range	13
Table A.6 – Communication command	14
Table A.7 – Reset type and interface	14
Table A.8 – Alarm functions	15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

DYNAMIC MODULES –

Part 6-11: Design guidelines – Software and hardware interface for optical multicast switches

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62343-6-11, which is a Technical Report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
86C/1604/DTR	86C/1612/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62343 series, published under the general title *Dynamic modules*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

IECNORM.COM : Click to view the full PDF of IEC TR 62343-6-11:2019

INTRODUCTION

An optical multicast switch (MCS) is a dynamic module that is mainly used in a reconfigurable optical add-drop multiplexer (ROADM) to realize a colourless, directionless and contentionless (CDC) function. The MCS functions as an optical switch and a non-wavelength dependent branching device. It is electrically controlled with software, which directs an input signal from one input port to the required output port. This document clarifies MCS software and hardware interfaces, which were investigated based on results from a survey by Dynamic Module Sub-Committee, Fibre Optic Standardization Committee, and OITDA (Optoelectronic Industry and Technology Development Association) in 2017. The questionnaire was sent to 24 appropriate companies all over the world via their representatives. Responses from six companies including three specific proposals for a specification were received.

IECNORM.COM : Click to view the full PDF of IEC TR 62343-6-11:2019

DYNAMIC MODULES –

Part 6-11: Design guidelines – Software and hardware interface for optical multicast switches

1 Scope

This part of IEC 62343, which is a Technical Report, proposes a software and hardware interface for the optical multicast switch (MCS). This switch can be controlled by resident firmware within the interface that is intended to enable a user or host to retrieve the switch status and/or adjust relevant switch settings. The MCS is defined in IEC 62343-3-4. The technical information regarding MCS and its applications in dense wavelength division multiplexing (DWDM) systems is described in IEC TR 62343-6-4. The objective of this document is a proposal for a software and hardware interface standard of MCS.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

There are no terms or definitions in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.2 Abbreviated terms

DWDM	dense wavelength division multiplexing
EEPROM	electrically erasable programmable read only memory
FPGA	field programmable gate array
I ² C	inter integrated circuit
LVTTL	low voltage transistor-transistor logic
MCS	optical multicast switch
MEMS	micro electro mechanical systems
MPU	microprocessor
O.C.	open collector
PLC	planar lightwave circuit
ROM	read only memory
SDRAM	synchronous dynamic random access memory
UART	universal asynchronous receiver transmitter

4 Survey results

4.1 Survey contents

The survey asked for a proposal for a software and hardware interface specification for an optical multicast switch for the purpose of standardization. It was not necessary for the respondent to be related directly to the multicast switch product, its application or its development.

4.2 Survey conditions

The survey was distributed to 24 companies including suppliers and users from December 15, 2015 to February 8, 2016. The responses were collected in a free format.

4.3 The analysis of responses

After reviewing all the responses, they were classified into three groups: A, B and C, as shown in Table 1. For each group and item, the results are summarized. The analysis results are shown in the summarized specification column. The details of the summarized specification are described in Annex A.

Table 1 – Analyzed results of software and hardware interface

	Group A	Group B	Group C	Summarized specification
Switch hardware configuration	Twin NxM	No description	Twin 4x8, Twin 8x16	Twin NxM
Request power supply	Basically 5,0 V. It is optional to assign +15 V to vendor reserved pins.	Single supply of either 3,3 V or 5,0 V	Only 5,0 V is described	5,0 V
Communication Interface	Either RS232C or I ² C. I ² C: I ² C-DATA (pin no. 19) I ² C-CLK (pin no. 21) or UART: UART Rx (pin no. 53) UART Tx (pin no. 55)	Either RS232C or I ² C or both I ² C: SDA (pin no 9) SCLK (pin no. 21) RS232C: RxD (pin no. 53) TxD (pin no.55)	LVTTTL UART serial interface SERIAL RxD (pin no. 53) SERIAL TxD (pin no. 55)	Both I ² C and UART(LVTTTL)
Electric connector shape	Samtec 60 pins 2 mm pitch male connector TMMH-130-01-G-D-EP. The portion "-01" designating the lead shape can be selected according to the mechanism design of the user side line card.	Samtec 60 pins 2 mm pitch male connector TMMH-130-04-F-DV-EP	60 pins 2 mm pitch male connector	60 pins (2 columns, 30 rows) 2 mm pitch male connector with guide poles
Electric connector pin assign	There is detailed information	There is detailed information	There is detailed information	We standardize the proposed specifications with content not mutually exclusive, as shown in Annex A

	Group A	Group B	Group C	Summarized specification
Alarm function	No description	No description	Abnormality of main constituting the MCS (for example, flash ROM, SDRAM, FPGA, oscillator, etc.)	Alarm function
			CPU abnormality notification by DC pin using WDT, etc.	
			Operation abnormality notice of the PLC or MEMS drive unit (for example, temperature abnormality, control pole fault abnormality, drive driver fault, etc.)	
			Power supply abnormality notification	
			Internal temperature abnormality notification (when heating parts are used)	
Reset function	There is a detailed description of the reset function	There are two descriptions: hardware reset and software reset	There is a detailed description of the reset function	Combine the reset functions of Group A and Group B and Group C

The communication format is analysed, as shown in Table 2, in the same manner.

Table 2 – Analyzed results of communication formats

	Group A	Group B	Group C	Proposed standard specification
Communication format (I ² C)	Details descriptions are available (communication parameters, communication format, object description, Alarm FIFO operation description). Regarding the implementation of I ² C, there is description that it follows [1] ¹	There is description about command list and pin assignment	No description	Combine the commands of Group A and Group B

¹ Numbers in square brackets refer to the Bibliography.

	Group A	Group B	Group C	Proposed standard specification
Communication format (RS232C)	No description	There is description of information (communication parameter, communication command) necessary for communication. Although it is described as RS232C as a communication IF, there is also a description of LVTTTL level. There is description about light intensity monitor and light attenuation setting.	No description	Although there is a RS232C method in Group B, this item is moved to the hardware interface of the UART because of the similarity
Communication format (UART)	There is detailed information (communication parameter, communication format, command explanation) used for communication	No description	There is no description, only pin assignment	Specify only the list of commands used for I ² C and UART

4.4 Future direction

Based on the survey results, the summarized specification is shown in Annex A. In order to establish a standard specification for a MCS software and hardware interface, additional information such as timing requirements, timing diagrams of power-on and reset, communication parameters such as clock frequency/ baud rate, data/communication format, packet structure, read/write transaction are required. The Dynamic Module Sub-Committee, Fibre Optic Standardization Committee, and OITDA (Optoelectronic Industry and Technology Development Association) will make a proposal for the standard specification including this missing information.

Annex A (informative)

Hardware and software interfaces

A.1 Hardware interfaces

A.1.1 Electrical connector

For electrical interface connectors, use a 60-pin male Samtec TMMH-130-01-G-D-EP compatible with 30 pins per column. Table A.1 shows the connector details. For the host device side connector, 60-pin female Samtec CLT-130-02-G-D-A compatible products are recommended.

Table A.1 – Connector form

No	Parameter	Value
1	Total pin number	60
2	Polarity	Male
3	Number of columns	2
4	Pin number per column	30
5	Pin pitch	2 mm

Figure A.1 shows the outline of the electrical interface connector and pin number assignment. The connector can be inserted in the wrong direction, and it is recommended to clearly indicate the position of pin no. 1 to prevent incorrect connection.



IEC

Figure A.1 – Connector appearance

A.1.2 Pin assignment and functions

Table A.2 shows the assignment of pin numbers and corresponding functions. Table A.3 shows a detailed explanation of the functions.

Table A.2 – Pin assignment

PIN	Signal	Input/output	Level	Function
1	VCC	-	-	Power supply + 5 V
2	VCC	-	-	Power supply + 5 V
3	VCC	-	-	Power supply + 5 V
4	VCC	-	-	Power supply + 5 V
5	VCC	-	-	Power supply + 5 V
6	VCC	-	-	Power supply + 5 V
7	GND	-	-	Ground
8	GND	-	-	Ground
9	GND	-	-	Ground
10	GND	-	-	Ground
11	GND	-	-	Ground
12	GND	-	-	Ground
13	Vendor reserved	-	-	Not connect
14	Vendor reserved	-	-	Not connect
15	Vendor reserved	-	-	Not connect
16	Vendor reserved	-	-	Not connect
17	Vendor reserved	-	-	Not connect
18	Vendor reserved	-	-	Not connect
19	SDA	Input/output	O.C.	I ² C DATA
20	GND	-	-	Ground
21	SCLK	Input	O.C.	I ² C CLK
22	GND	-	-	Ground
23	SC	Output	O.C.	Status change (active low)
24	Vendor reserved	-	-	Not connect
25	Vendor reserved	-	-	Not connect
26	Vendor reserved	-	-	Not connect
27	HWSET	Input	LVTTTL	MPU reset (active low)
28	GND	-	-	Ground
29	MRST	Input	LVTTTL	Master reset (active low)
30	GND	-	-	Ground
31	RST_OUT	Output	O.C.	MPU reset monitor (active low)
32	GND	-	-	Ground
33	Vendor reserved	-	-	Not connect
34	GND	-	-	Ground
35	Disable	Input	LVTTTL	Disable (active high)
36	GND	-	-	Ground
37	WDT	Output	O.C.	MPU fail
38	Vendor reserved	-	-	Not connect
39	Vendor reserved	-	-	Not connect
40	Vendor reserved	-	-	Not connect
41	Vendor reserved	-	-	Not connect
42	Vendor reserved	-	-	Not connect

PIN	Signal	Input/output	Level	Function
43	Vendor reserved	-	-	Not connect
44	Vendor reserved	N/A	N/A	Not connect
45	Vendor reserved	N/A	N/A	Not connect
46	Vendor reserved	N/A	N/A	Not connect
47	GND	N/A	N/A	Ground
48	GND	N/A	N/A	Ground
49	GND	N/A	N/A	Ground
50	GND	N/A	N/A	Ground
51	GND	N/A	N/A	Ground
52	GND	N/A	N/A	Ground
53	RxD	Input	LVTTL	Serial RxD
54	GND	N/A	N/A	Ground
55	TxD	Output	LVTTL	Serial TxD
56	Vendor reserved	N/A	N/A	Not connect
57	HW_ERR	Output	O.C.	HW error alarm (active low)
58	Vendor reserved	N/A	N/A	Not connect
59	Vendor reserved	N/A	N/A	Not connect
60	Vendor reserved	N/A	N/A	Not connect

NOTE 1 O.C. pull-up to 3,3 V at 10 kΩ on the host device side.

NOTE 2 LVTTL 3 V TTL compatible. Pulled-up with 4,7 kΩ to 3,3 V in MCS.

NOTE 3 "N/A" indicates "not applicable".

Table A.3 – Explanation of functions

Signal	Functions	Description
VCC	Power supply	Power supply pin. It receives supply of +5 V power supply to drive MCS.
GND	Ground	Ground 0 V
Vendor reserved	Vendor reserved	Do not connect anything on the user side
SDA	DATA I ² C	Communication data line for I ² C Fast mode: 400 kbit/s compatible
SCLK	CLK I ² C	Communication clock line for I ² C Fast mode – 400 kbit/s compatible
SC	Status change output	Alarm data announcement It goes low while information is present in the alarm buffer.
HWRST	uP RST input	Hardware reset. When it is set to low level, MPU reset is performed. It involves register initialization. The path setting and the attenuation amount of the light do not change, and the optical communication is maintained.
MRST	Master RST input	Master reset. When it is set to the low level, the MPU and the register are reset, the attenuation amount of all the optical paths is set to the maximum, and the optical communication is cut off. Behavior of other terminals during resetting is unquestioned.
RST_OUT	uP RST monitor output	Reset output. It goes low while the MPU is resetting. It is deasserted when the modules behavior is ready.

Signal	Functions	Description
Disable	SW max attenuation input	When the 35 th pin is set to the high level, the light attenuation amount of all the optical paths is set to the maximum. While the disable is active, the communication function is maintained and the route information can be changed. When pin no. 35 is returned to the low level and disable is negated, the updated route information becomes valid.
WDT	Watch dog timer	Notify when MPU error occurs. It goes low while an error occurs in the MPU.
RxD	Serial data input	Module-side receive line of asynchronous serial interface MCS receives data on this line. The maximum communication rate is 115,2 kbps.
TxD	Serial data output	Module side transmission line of asynchronous serial interface MCS sends data on this line. The maximum communication rate is 115,2 kbps.
HW_ERR	Hardware error alarm output	Hardware error notification output It is set to low level when a hardware power supply/clock related fault occurs.

Table A.4 shows the power supply voltage range required for the VCC pin.

Table A.4 – Power supply voltage range

Symbol	Min.	Typ.	Max.	Unit
VCC	4,75	5,0	5,25	V

Table A.5 shows the requirements for the LVTTTL signal level used for the communication terminal and some function pins.

Table A.5 – Logical pin voltage range

Parameter	Symbol	Min.	Max.	Unit
Logic low input level	VIL	-	0,8	V
Logic high input level	VIH	2,0	5,5	V
Logic low output level	VOL	-	0,4	V
Logic high output level	VOH	2,4	3,3	V

A.2 Software interfaces

A.2.1 General

For command communication, a UART communication system or I²C communication system is used.

A.2.2 UART communication

For UART communication, use RxD (pin no. 53) and TxD (pin no. 55).

A.2.3 I²C communication

For I²C communication, use SDA (pin no. 19) and SCLK (pin no. 21). The host device side is the master, and the MCS is the slave, which complies with [2].

A.2.4 Command sets

Both UART and I²C communication systems support the command set in Table A.6.

Table A.6 – Communication command

Command type/description	Read/Write
MCS responds the current echo setting state	Read
Setting echo information (On/Off)	Write
MCS responds the current UART communication rate	Read
Set the UART communication rate (9 600 bit/s, 19 200 bit/s, 38 400 bit/s, 57 600 bit/s, 115 200 bit/s)	Write
Update the MPU firmware	Write
MCS responds module information (vendor name, vendor product model, firmware version, hardware version, EEPROM version, serial number, etc.)	Read
Set the optical path for each port (unit number, switch channel number, in-switch path number)	Write
Set all light paths at once	Write
MCS responds the optical path setting value per port (unit number, switch channel number)	Read
Read all routes at once	Read
MCS responds the state of the disable (Disable: pin no. 35) signal	Read
MCS responds alarm information of module	Read
Set the restart flag to "1"	Write
MCS responds the current value of restart flag	Read
Reset the MPU (register content, optical path; attenuation amount does not change; optical communication is maintained)	Write
MCS responds the optical monitor value of the optical path (unit number, switch channel number)	Read
Set the optical attenuation amount of the optical path [unit number, switch channel number, optical attenuation (dB)]	Write
MCS responds the optical attenuation amount of the optical path (unit number, switch channel number)	Read
Hardware test	Write
Switch communication path (UART to I ² C, I ² C to UART)	Write

A.2.5 Reset

The type and interface for the reset function are shown in Table A.7.

Table A.7 – Reset type and interface

Reset type	Symbol	Interface	Description
Power on reset	PO_RST	Built-in power supply monitoring IC	Reset automatically when power is turned on. Also, reset when power supply abnormality is detected.
Master reset	MRST	Pin no. 29	Master reset is activated by setting pin no. 29 to low level. MPU and registers in the module are initialized. After the reset, all the optical paths are set to the maximum light attenuation amount, and the optical communication is cut off.
Hardware reset	HWRST	Pin no. 27	Hardware reset is activated by setting pin no. 27 to low level. MPU and registers are initialized, but route setting is maintained. When a voluntary MPU reset is activated in the module, a hardware reset is activated.