DATALOGIC

Absolute Encoders

AMT58...13x12 CB

CANopen

Ds406 - Device Profile for Encoders

Instruction Manual

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Typographic and iconographic conventions

In this guide, to make it easier to understand and read the text the following typographic and iconographic conventions are used:

- parameters and objects both of the device and the interface are coloured in ORANGE;
- alarms are coloured in RED;
- states are coloured in FUCSIA.

When scrolling through the text some icons can be found on the side of the page: they are expressly designed to highlight the parts of the text which are of great interest and significance for the user. Sometimes they are used to warn against dangers or potential sources of danger arising from the use of the device. You are advised to follow strictly the instructions given in this guide in order to guarantee the safety of the user and ensure the performance of the device. In this guide the following symbols are used:

⚠	This icon, followed by the word WARNING, is meant to highlight the parts of the text where information of great significance for the user can be found: user must pay the greatest attention to them! Instructions must be followed strictly in order to guarantee the safety of the user and a correct use of the device. Failure to heed a warning or comply with instructions could lead to personal injury and/or damage to the unit or other equipment.
ⓘ	This icon, followed by the word NOTE, is meant to highlight the parts of the text where important notes needful for a correct and reliable use of the device can be found. User must pay attention to them! Failure to comply with instructions could cause the equipment to be set wrongly: hence a faulty and improper working of the device could be the consequence.
ℹ	This icon is meant to highlight the parts of the text where suggestions useful for making it easier to set the device and optimize performance and reliability can be found. Sometimes this symbol is followed by the word EXAMPLE when instructions for setting parameters are accompanied by examples to clarify the explanation.

Preliminary information

This guide is designed to describe the technical characteristics, installation and use of the CANopen encoders of the AMT58 series.
For any further information please refer to the product datasheet.

To make it easier to read the text, this guide is divided into two main sections.
In the first section general information concerning the safety, the mechanical installation and the electrical connection as well as tips for setting up and running properly and efficiently the unit are provided.
In the second section, entitled CANopen Interface, both general and specific information is given on the CANopen interface.
In this section the interface features and the objects implemented in the unit are fully described.

1. 1 - Safety summary

Safety

- Always adhere to the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and stationary mechanical parts;
- device must be used only for the purpose appropriate to its design: use for purposes other than those for which it has been designed could result in serious personal and/or the environment damage;
- high current, voltage and moving mechanical parts can cause serious or fatal injury;
- failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment;
- Datalogic Automation S.r.l. assumes no liability for the customer's failure to comply with these requirements.

Electrical safety

- Turn off power supply before connecting the device;
- connect according to explanation in section “4 – Electrical connections”.
- in compliance with the 2004/108/EC norm on electromagnetic compatibility, following precautions must be taken:
  - before handling and installing, discharge electrical charge from your body and tools which may come in touch with the device;
  - power supply must be stabilized without noise, install EMC filters on device power supply if needed;
  - always use shielded cables (twisted pair cables whenever possible);
  - avoid cables runs longer than necessary;
  - avoid running the signal cable near high voltage power cables;
  - mount the device as far as possible from any capacitive or inductive noise source, shield the device from noise source if needed;
  - to guarantee a correct working of the device, avoid using strong magnets on or near by the unit;
  - minimize noise by connecting the shield and/or the frame to ground. Make sure that ground is not affected by noise. The connection point to ground can be situated both on the device side and on user’s side. The best solution to minimize the interference must be carried out by the user.

Mechanical safety

- Install the device following strictly the information in the section "3 – Mounting instructions".
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the encoder;
- do not tool the encoder or its shaft;
- delicate electronic equipment: handle with care; do not subject the device and the shaft to knocks or shocks;
- respect the environmental characteristics declared by manufacturer;
- unit with solid shaft: in order to guarantee maximum reliability over time of mechanical parts, we recommend a flexible coupling to be installed to connect the encoder and user's shaft; make sure the misalignment tolerances of the flexible coupling are respected;
- unit with hollow shaft: the encoder can be mounted directly on a shaft whose diameter has to respect the technical characteristics specified in the purchase order and clamped by means of the collar and, when requested, the anti-rotation pin.

2. Identification

Device can be identified through the ordering code and the serial number printed on the label applied to its body.
Information is listed in the delivery document too.

Please always quote the ordering code and the serial number when reaching Datalogic Automation s.r.l. for purchasing spare parts or needing assistance.

For any information on the technical characteristics of the product refer to the technical catalogue.

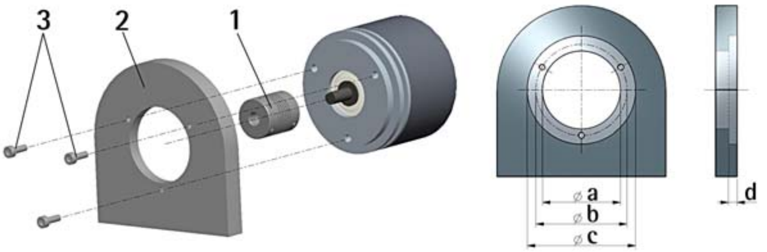
3. Mounting instructions

WARNING
Installation has to be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.

3.1 Solid shaft encoders

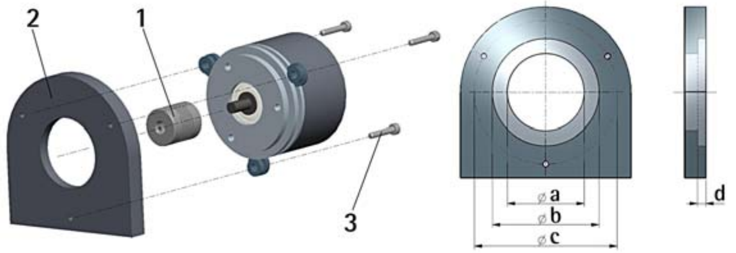
- Mount the flexible coupling 1 on the encoder shaft;
- fix the encoder to the flange 2 (or to the mounting bell) by means of screws 3;
- secure the flange 2 to the support (or the mounting bell to the motor);
- mount the flexible coupling 1 on the motor shaft;
- make sure the misalignment tolerances of the flexible coupling 1 are respected.

3.1.1 Customary installation



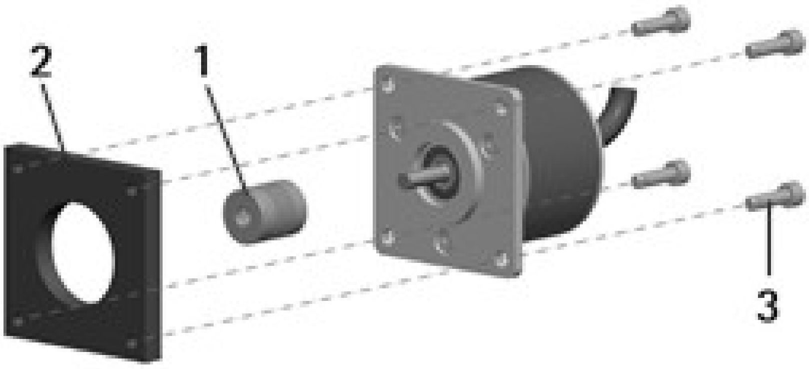
	a [mm]	b [mm]	c [mm]	d [mm]
AMT58	36 H7	48	-	-

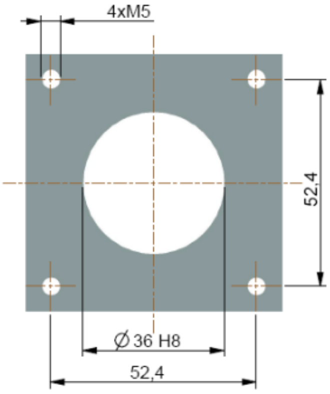
3.1.2 Fissaggio con graffe (codice ST-58-KIT)



	a [mm]	b [mm]	c [mm]	d [mm]
AMT58	36 H7	-	67	-

3.1.3 Installation using a flange (code ST-58-FLNG)

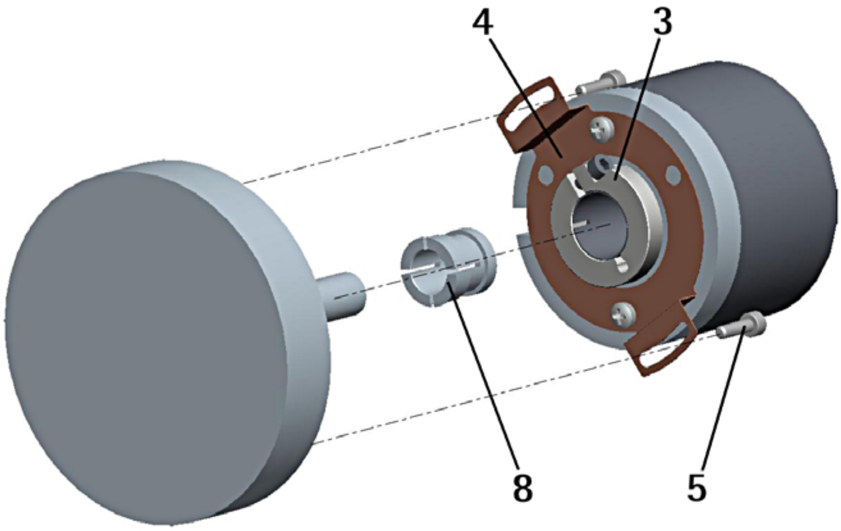


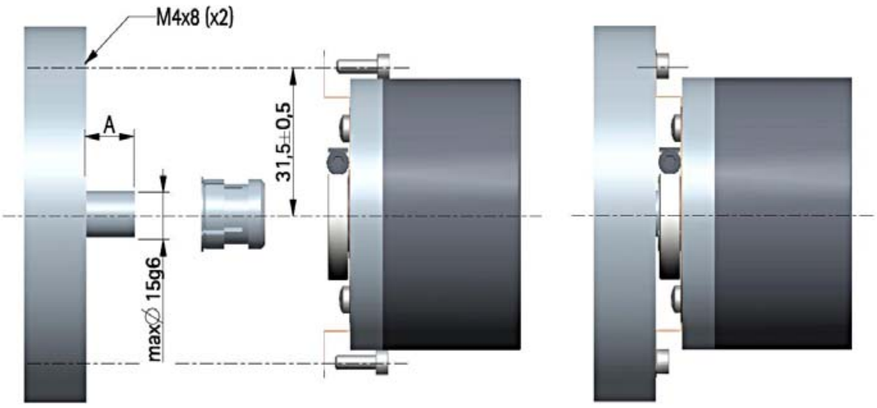


3.2 Hollow shaft encoders

3.2.1 AMT58-H15

- Mount the encoder on the motor shaft using the reducing sleeve 8 (if supplied). Avoid forcing the encoder shaft;
- fasten the fixing plate 4 to the rear of the motor using two M3 cylindrical head screws 5;
- fix the collar 3 to the encoder shaft (apply threadlocker to screw 3).





4. Electrical connections

WARNING
Power supply must be turned off before performing any electrical connection!

4.1 Connection cap

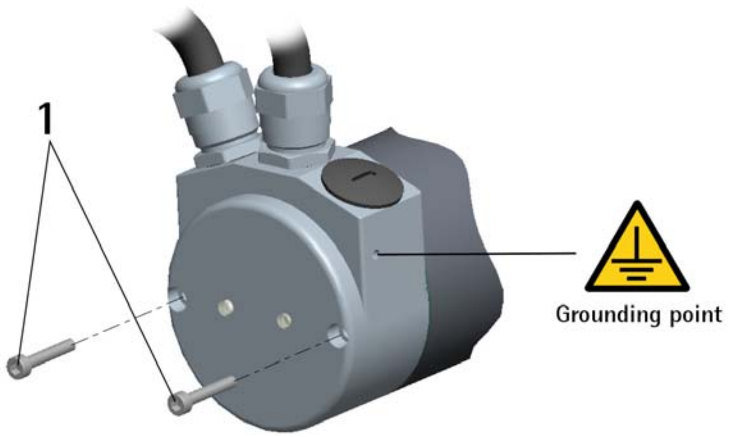
WARNING
Do not remove or mount the connection cap with power supply switched ON. Damage may be caused to internal components.

The terminal connectors for connecting the power supply and the BUS IN and BUS OUT cables (CC-CB connection cap) as well as the dip-switches meant to set the baud rate and the node ID and activate the termination resistance are located inside the encoder connection cap. Thus you must remove the connection cap to access any of them.

NOTE
Be careful not to damage the internal components when you perform this operation.

To remove the connection cap loosen the two screws 1.
Please be careful with the internal connector.
Always replace the connection cap at the end of the operation.
Take care in re-connecting the internal connector. Tighten the screws 1 using a tightening torque of approx. 2.5 Nm.

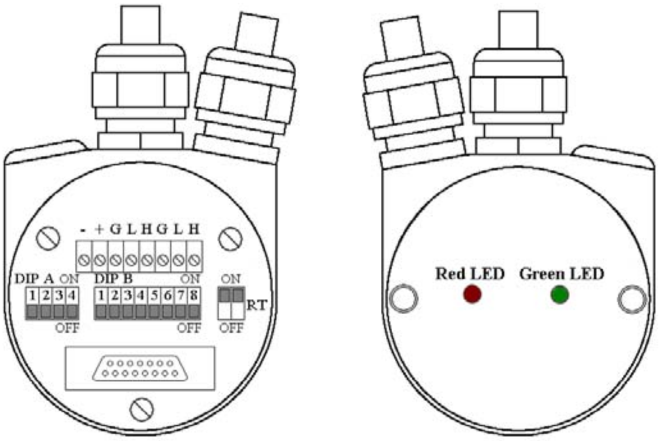
WARNING
You are required to check that the encoder body and the connection cap are at the same potential before replacing the connection cap!



4.2 Ground connection

Minimize noise by connecting the shield and/or the connector housing and/or the frame to ground. Make sure that ground is not affected by noise. The connection point to ground can be situated both on the device side and on user's side.
The best solution to minimize the interference must be carried out by the user. You are advised to provide the ground connection as close as possible to the encoder. We suggest using the ground point provided in the cap (see Figure, use 1 TCEI M3 x 6 cylindrical head screw with 2 tooth lock washers).

4.3 Connection cap



The connection cap is fitted with two PG9 cable glands for bus-IN, bus-OUT and supply voltage connections. The bus cables can be connected directly to the terminal connectors in front of each cable gland. It is recommended to use CANbus certificated cables.
Core diameter should not exceed Ø 1,5 mm (0.06 inches).

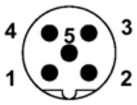
Clamp	Description
-	0 VDC Supply voltage
+	+10VDC +30VDC Supply voltage
G	CAN GND [1]
L	CAN Low
H	CAN High
PG	CAN Shield [2]

[1] *CAN GND is the 0V reference of CAN signals, it is not connected to 0VDC supply voltage.*
[2] *Connect cable shield to cable gland.*

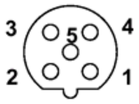
4.4 Connection cap with M12 connectors

The connection cap has two M12 connectors with pin-out in compliance with CANopen® standard. Therefore you can use standard CAN cables commercially available.

M12 connector
A coding
(frontal side)



male
(BUS IN)



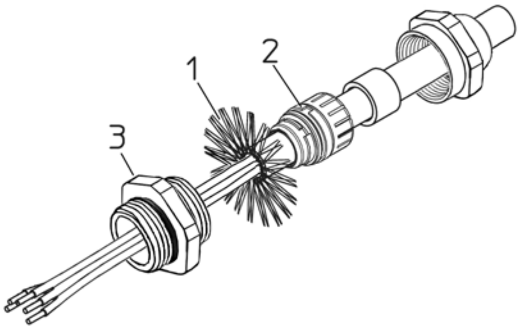
female
(BUS OUT)

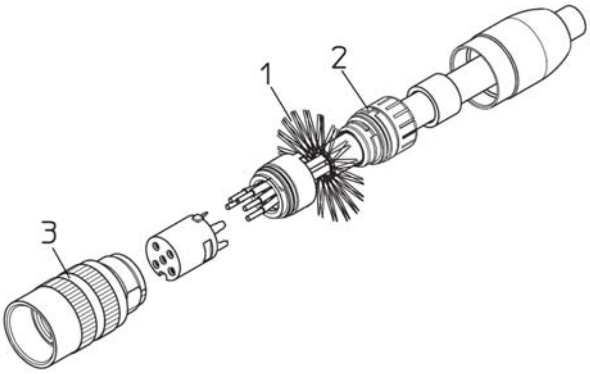
M12	Description
Case	CAN Shield
1 [1]	
2	+10Vdc +30Vdc Supply voltage
3	0 Vdc Supply voltage
4	CAN High
5	CAN Low

[1] CAN Shield is also connected to pin 1 to allow the connection of the shield even if the plug connector has a plastic case.

4.5 Connection of the shield

Disentangle and shorten the shielding 1 and then bend it over the part 2; finally place the ring nut 3 of the connector.
Be sure that the shielding 1 is in tight contact with the ring nut 3.



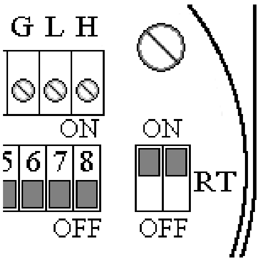


4.6 RT Bus termination

WARNING
Power supply must be turned off before performing this operation!

A bus termination resistance is provided in the connection cap and has to be activated as line termination in the last device of the transmission line.
Use RT Switch to activate or deactivate the bus termination.

RT	Description
1 = 2 = ON	Activated: if the encoder is the last device in the transmission line
1 = 2 = OFF	Deactivated: if the encoder is not the last device in the transmission line



4.7 Diagnostic LEDs

Two diagnostic LEDs located in the rear side of the connection cap are designed to show the operating or fault status of the CANopen® interface.

GREEN LED	Description
ON	Encoder is in Operational state
Single flash	Encoder is in Stopped state
Blinking	Encoder is in Pre-Operational state

RED LED	Description
ON	The CAN controller is switched off
Double flash	Node guarding error
Single flash	Max. number of warning errors
Blinking	Generic error or Flash memory error
OFF	No error

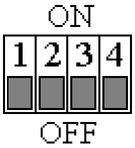
During initialization, device carries out a hardware test to check LEDs operation. Both LEDs light up.

4.8 Baud rate: DIP A

WARNING
Power supply must be turned off before performing this operation!

Transmission rate can be set either via hardware or via software.
If DIP A bit 4 = ”OFF” the bit rate is set through object **3000-00 Baud rate** in the “Object Dictionary” and can be modified using SDO messages.
If DIP A bit 4 = ”ON” the bit rate is set by DIP A.

DIP A:



Set binary value of transmission rate considering that: ON=1, OFF=0.

bit	1 LSB	2	3 MSB	4
	2^0	2^1	2^2	ON/OFF

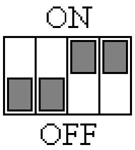
Available baud rate values:

Decimal value	Binary value	Baud rate
0	000	20 Kbit/s
1	001	50 Kbit/s
2	010	100 Kbit/s
3	011	125 Kbit/s
4	100	250 Kbit/s
5	101	500 Kbit/s (default)
6	110	800 Kbit/s
7	111	1000 Kbit/s

Example

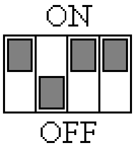
Set 250Kbit/s:
$4_{10} = 100_2$ (binary value, see table above)

bit	1	2	3	4
	2^0	2^1	2^2	2^3
	OFF	OFF	ON	ON



Set 500Kbit/s:
$5_{10} = 101_2$ (binary value, see table above)

bit	1	2	3	4
	2^0	2^1	2^2	2^3
	ON	OFF	ON	ON



4.9 Node number: DIP B

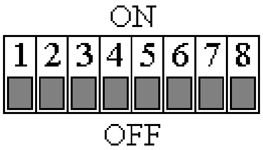
WARNING
Power supply must be turned off before performing this operation!

Node number can be set both via hardware or via software.
Allowed node addresses range between 1 and 127.
The default value is 1.

If all bits of DIP B are "OFF" node number is set through object **3001-00 Node-ID** of the "Object Dictionary" and can be modified using SDO messages.

If one bit at least of DIP B is set to "ON" the node number is set through DIP B.

DIP B:

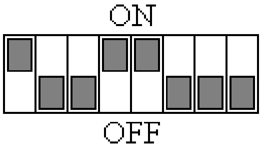


Set the node number in binary value: ON=1, OFF=0

bit	1 LSB	2	3	4	5	6	7 MSB	8 not used
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	

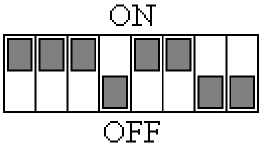
Example
Set node number = 25:
$25_{10} = 0001\ 1001_2$ (binary value)

bit	1	2	3	4	5	6	7	8
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	
	ON	OFF	OFF	ON	ON	OFF	OFF	OFF



Set node number = 55:
$55_{10} = 0011\ 0111_2$ (binary value)

bit	1	2	3	4	5	6	7	8
	2^0	2^1	2^2	2^3	2^4	2^5	2^6	
	ON	ON	ON	OFF	ON	ON	OFF	OFF



WARNING
If baud rate and node number are set via software, master device has to detect the baud rate of the slave (scanning of baud rate) when the encoder is being installed. Once communication has been activated new baud rate and node number values can be set (objects **3000-00 Baud rate** and **3001-00 Node-ID**). After having set new values, transmit a **Reset node** command and then save parameters (object **1010-01 Store parameters**).To avoid conflict between Slaves, this operation has to be carried out when one only device is connected to the network.

5. Quick reference

5.1 Hardware resolution

WARNING
Make sure the physical resolution of the encoder matches the set resolution.
Different resolutions may be set if the encoder and the connection cap have been ordered / supplied separately.

Examples

AMT58 12/4096	**6501-00 Hardware counts per revolution** = 4096, **6502-00 Hardware number of turns** = 4096.
AMT58 13/4096	**6501-00 Hardware counts per revolution** = 8192, **6502-00 Hardware number of turns** = 4096.

6501-00 Hardware counts per revolution object is described on page 40.
6502-00 Hardware number of turns object is described on page 36.
If the hardware resolution does not match the ordering code (see encoder label) then it is compulsory to set the hardware resolution (for any information on reading the hardware resolution refer to section "5.2 Using the default settings").
Please note that the parameters **6001-00 Counts per revolution** and **6002-00 Total resolution** refer to the scaling function, anyway the unit can run properly only if the hardware resolution is set correctly.

5.1.1 Procedure to set hardware resolution

ID = node identifier.

Step 1 - Access to the configuration (object 3002h)

NOTE
To avoid unintentional access, this object is not listed in the EDS file.

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	02	30	00	41	4B	49	4C

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	02	30	00	00	00	00	00

Step 2 - **Set object 6501-00 Hardware counts per revolution**

See resolution table below in the page for B0, B1, B2 and B3 values.

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	01	65	00	B0	B1	B2	B3

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	01	65	00	00	00	00	00

Step 3 - **Set object 6502-00 Hardware number of turns**

See resolution table below in the page for B4, B5, B6 and B7 values.

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	02	65	00	B4	B5	B6	B7

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	02	65	00	00	00	00	00

Step 4 - Send a Reset node command

Master → Encoder

COB-ID	Cmd	Slave ID
000	81	ID

Step 5 - **Store parameters (object 1010-01 Store parameters)**

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	10	10	01	73	61	76	65

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	10	10	01	00	00	00	00

Table of resolutions

Encoder type	steps/rev.				n° rev.			
	B0	B1	B2	B3	B4	B5	B6	B7
AMT58 12/4096	00	10	00	00	00	10	00	00
AMT58 13/4096	00	20	00	00	00	10	00	00

5.2 Using the default settings

Using the default settings provided by the manufacturer, you can switch on the device and read immediately its position.

Follow the instructions below to:

- read the device resolution;
- set the operational mode;
- read the current position (cyclic mode and/or sync mode).

Default Baud rate and Node-ID are:
Baud rate = 500 Kbit/s
Node-ID = 1

Read resolution **revolution** **6501-00 Hardware counts per revolution**

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
601	40	01	65	00	-	-	-	-

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
581	43	01	65	01	A0	A1	A2	A3

steps/rev. = ((A3<<24) | (A2<<16) | (A1<<8) | A0)

Read number of **revolutions** **6502-00 Hardware number of turns**

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
601	40	02	65	00	-	-	-	-

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
581	43	02	65	01	B0	B1	B2	B3

N. rev. =((B3<<24) | (B2<<16) | (B1<<8) | B0)

Set cyclic **time** **6200-00 Cyclic time** (100 ms = 64h)

Master → Encoder

COB-ID	Cmd	Index		Sub	Process data			
600+ID	2B	00	62	00	64	00	-	-

Encoder → Master

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	00	62	00	00	00	-	-

Set Operational mode

Master → Encoder

COB-ID	Cmd	Node
000	01	01

Read the position every 100 ms

Encoder → Master

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3
181	Low	…	…	High

6. CANopen® interface

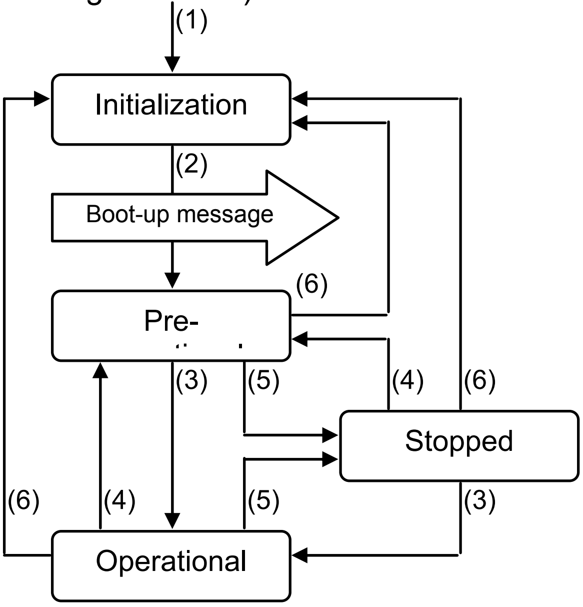
Datalogic encoders are always slave devices and comply with "Device profile for encoders", Class 2.
For any omitted information, refer to the "CiA Draft Standard 301" and "CiA Draft Standard 406" documents available at www.can-cia.org.

6.1 EDS file

CANopen® encoders are supplied with their own EDS file **AMT58-xxx-13x12-CB** (see enclosed documentation or click www.datalogic.com).
EDS file has to be installed on CANopen® master device.

6.2 Operation states

CANopen® devices are designed to operate using different states. Transition from one state to another is made by sending specific NMT messages (see Figure below).



(1)	Power on
(2)	Initialization carried out, boot-up message is sent automatically
(3)	NMT message: Start remote node
(4)	NMT message: Enter pre-operational
(5)	NMT message: Stop remote node
(6)	NMT message: Reset node or Reset communication

6.2.1 Initialization state

This is the first state the CANopen® device enters after power is turned on or after a hardware reset. As soon as the basic CANopen® device initialization is carried out, device reads and loads the parameters saved on EPROM, sends a boot-up message and then switches automatically to Pre-operational state.

6.2.2 Pre-operational state

In this state communication between master and slave is possible using SDO messages. They allow working parameters to be set. Slave cannot send PDO messages.
To switch slave device to Operational state master must send a Start remote node command using a NMT message.

6.2.3 Operational state

In this state slave device is active and all communication objects are available. Slave device can use the parameters available in the “Object dictionary” and is allowed to send process data using PDO messages. “Object dictionary” can be accessed using SDO messages. To switch slave device to Pre-operational state master must send an Enter pre-operational command using a NMT message.

6.2.4 Stopped state

In this state slave device is forced to interrupt communication with the Master (except node guarding, if active).
Communication using PDO and SDO messages is not allowed.
To switch slave device to Pre-operational or Operational state master must send the specific commands Enter pre-operational or Start remote node using a NMT message.

6.3 Communication objects

Four different kinds of communication messages are used in a CANopen® network:

- Network management NMT protocol: NMT protocols are used to issue state machine change commands (i.e. to start and stop the devices), detect remote device boot-ups and error conditions.
- Process Data Objects PDO protocol: used to process real time data (transmission of process data in real time).
- Service Data Objects SDO protocol: used to set and read values from the object dictionary of a remote device.
- Special Function Objects:
  - SYNC: synchronization message used by master to enable slaves devices to transmit process data (encoder position and velocity).
  - Emergency: error messages are triggered by each error event.
  - Nodeguard: used to request the state of the slave.

Relation between device states and communication objects:

	Initial.	Pre-oper.	Operat.	Stopped
NMT		X	X	X
PDO			X	
SDO		X	X	
SYNC			X	
EMCY		X	X	
Boot-up	X			
Node guard		X	X	X

6.3.1 Pre-defined connection set

Master → Slave broadcast		
Type of COB (Object)	Function code (binary)	COB-ID (hex)
NMT	0000	000
SYNC	0001	080

peer-to-peer transmission		
EMERGENCY	0001	081 - 0FF
PDO 1 (tx)	0011	181 - 1FF
PDO 2 (tx)	0101	281 - 2FF
PDO 3 (tx)	0111	381 - 3FF
PDO4 (tx)	1001	481 - 4FF
SDO (tx)	1011	581 - 5FF
SDO (rx)	1100	601 - 67F
Node guard	1110	701 - 77F
Boot-up	1110	701 - 77F

The type of COB (tx or rx) is viewed from the slave device.

6.4 NMT objects

NMT structure:

COB-ID (11 bit)	
Func.code	Node ID
0000	0

2 CAN Data Bytes	
Command	Slave ID
NMT Func.	Slave ID

If Slave ID = 00h, the NMT message is issued to all network nodes.

NMT Function:

Command	NMT Function	State node
01 hex	Start remote node	Operational
02 hex	Stop remote node	Stopped
80 hex	Enter pre-operational	Pre-operational
81 hex	Reset node	Pre-operational
82 hex	Reset communication	Pre-operational

6.5 Boot-up objects

Boot-up message structure:

COB-ID(hex)
700+Node ID

1 CAN Data Bytes
00

6.6 PDO objects

PDO (tx) messages are always made up of 4 CAN Data Bytes and are used by the encoder to transmit the position value and/or the velocity value.

PDO structure:

IDENTIFIER	
COB-ID(hex)	
F.C.	Node-ID

4 CAN Data Bytes			
Byte 0	Byte 1	Byte 2	Byte 3
Low	…	…	High
position value (with PDO1, PDO2, PDO3)			
velocity value (with PDO4)			

PDO1 Cyclic mode: cyclic transmission

Encoder uses the PDO1 message to transmit the position value cyclically, i.e. periodically and independently from the Master.
The interval between two issues is set in the object **6200-00 Cyclic time**. To activate (or deactivate) cyclic mode it is necessary to set to 0 (or 1) the most significant bit of COB-ID used by PDO1 (object **1800 PDO1 parameters**, sub 1).

PDO2 and PDO3 SYNC mode: synchronous transmission

Transmission of position value is managed by the Master by sending a SYNC message.
SYNC message is a high-priority COB transmitted by the Master to request the position value of the encoder.
If several nodes (encoders) are connected to the network, the Master receives the position values from the slaves respecting the Node number order.

The encoder can be programmed to send a reply after a set number of SYNC messages by setting a counter.
The PDO message will be transmitted after having received the set number of SYNC messages.
For PDO2 the value of the counter must be set in object **1801 PDO2 parameters**, sub 2.
For PDO3 refer to object **1802 PDO3 parameters**, sub 2.
SYNC transmission mode can be enabled (or disabled) by setting to 0 (or 1) the most significant bit (MSB) of COB-IB used by PDO (objects **1801 PDO2 parameters** / **1802 PDO3 parameters**, sub1).

PDO4 Cyclic mode: cyclic transmission

Encoder uses the PDO4 message to transmit the velocity value cyclically, i.e. periodically and independently from the Master.
The interval between two issues is set in the object **6200-00 Cyclic time**. To activate (or deactivate) the cyclic mode it is necessary to set to 0 (or 1) the most significant bit of COB-ID used by PDO4 (object **1803 PDO4 parameters**, sub 1).

NOTE
Several transmission modes can be active at the same time.

6.7 SDO objects

SDO messages are used to set and read values from the object dictionary of the encoder.
These parameters are described in the “Object dictionary” section.
4 bytes at the most are used for CAN data, other 4 bytes are used for Command, Index and Sub-index fields. SDO messages are always followed by confirmation. It follows that when Master sends a SDO message to Slave, slave always sends a reply (and a warning, should an error occur).

SDO structure:

IDENTIFIER	
COB-ID(hex)	
F.C.	Node-ID

from 4 to 8 CAN data bytes							
0	1	2	3	4	5	6	7
Com	Index		Sub	Data			
1byte	LSB	MSB	1byte	LSB	…	…	MSB

Com	command
Index	parameter index
Sub	parameter sub-index
Data	parameter value

6.7.1 Command

The command byte contains the type of telegram transmitted to the CAN network.
Three types of telegram are available:

- Set: to send configuration parameters to a device;
- Req: used by master to read data from a device;
- Warnings: used by slave to send error messages to master (e.g. Index does not exist, …).

Command	COB	COB type	Data length
22h	Set	M → S request	not spec.
23h	Set	M → S request	4 byte
2Bh	Set	M → S request	2 byte
2Fh	Set	M → S request	1 byte
60h	Set	S → M confirmation	0 byte
40h	Req	M → S request	0 byte
42h	Req	S → M reply	not spec.
43h	Req	S → M reply	4 byte
4Bh	Req	S → M reply	2 byte
4Fh	Req	S → M reply	1 byte
41h	Req	S → M reply segmented SDO	
80h	Warning	S → M reply	4 byte

6.8 Object dictionary

In the following pages the objects implemented are listed and described as follows:

Index-subindex Object name
[data types, attribute]

- Index and subindex are expressed in hexadecimal notation.
- Attribute:
  ro = read only access
  rw = read and write access

Unsigned16 data type:

Process data bytes	
byte 4	byte 5
LSByte	MSByte

Unsigned32 data type:

Process data bytes			
byte 4	byte 5	byte 6	byte 7
LSByte	…	…	MSByte

6.8.1 Standard objects (DS 301)

1000-00 Device type

[Unsigned32, ro]
Default = 0001 0196h= singleturn encoder, DS 406
0002 0196h= multiturn encoder, DS 406

1001-00 Error register

[Unsigned8, ro]
Should an error occur, bit 0 in this object will be set to "1".
Default = 00h

1003 Pre-defined error field

This object contains the last four errors which generated an emergency message.

- 00 Number of current errors [Unsigned8, rw]
  (write 00h to delete the error history)
- 01 Last error occurred [Unsigned32, ro]
- 02-04 Previous errors occurred [Unsigned32, ro]1005-00 COB_ID SYNC message

[Unsigned32, rw]
Default = 0000 0080h

1008-00 Name of device manufacturer

[String, ro]
It shows the name of the device manufacturer.
Default = “Datalogic Automation Srl”

1009-00 Hardware version

[String, ro]
It shows the hardware version of the device.

100A-00 Software version

[String, ro]
It shows the software version of the device.

100C-00 Guard time

[Unsigned16, rw]
It contains the Guard time expressed in msec (milliseconds).
Object **100C-00 Guard time** is used in the “Node guarding protocol” controlled by the master. For more details see section “6.11 Node guarding protocol”.
Default = 0000h

100D-00 Life time factor

[Unsigned8, rw]
Object **100D-00 Life time factor** is used in the “Node guarding protocol” controlled by the master. For more details see section “6.11 Node guarding protocol”.
Default = 00h

1010-01 Store parameters

[Unsigned32, rw]
Use this object to save all parameters on non-volatile memory.
Write "save" (ASCII code in hexadecimal form) in the data bytes:

Master → Encoder

COB-ID	Cmd	Index		Sub	Data bytes			
600+ID	23	10	10	01	73	61	76	65

Encoder → Master (confirmation)

COB-ID	Cmd	Index		Sub	Data bytes			
580+ID	60	10	10	01	00	00	00	00

1011-01 Restore default parameters

[Unsig32, rw]
This object allows the operator to restore all parameters to default values (default values are set at the factory by Datalogic Automation engineers to allow the operator to run the device for standard operation in a safe mode).
Write "load" (ASCII code in hexadecimal form) in the data bytes and then issue a Reset node command:

Master → Encoder

COB-ID	Cmd	Index		Sub	Data bytes			
600+ID	23	11	10	01	6C	6F	61	64

Encoder → Master (confirmation)

COB-ID	Cmd	Index		Sub	Data bytes			
580+ID	60	11	10	01	00	00	00	00

Master → Encoder (Reset node)

COB-ID	Cmd	Slave ID
000	81	ID

Encoder → Master (Boot-up)

COB-ID	Cmd
700+ID	00

NOTE
Save default values using the store parameters function (see object **1010-01Store parameters**).

1014-00 COB-ID EMCY

[Unsigned32, rw]

This object defines the COB-ID used for sending emergency messages (EMCY).

If the node address is set using the internal dip-switches (i.e. at least one dip-switch for setting the node has HIGH logic level = 1), when the power is turned on, this object is always forced to the default value. Otherwise, if the node address is set via software (i.e. all dip-switches for setting the node have LOW logic level = 0) it retains the set value, unless a software procedure for setting a new address is forced at power on.

Default = 0000 0080h+NodeID

1015-00 Inhibit time EMCY

[Unsigned16, rw]

Inhibit time of the emergency messages (EMCY) expressed in multiples of 100 µs. When set to 0, this function is disabled.

Default = 0000h

1018 Identification object

- 01 Vendor number [Unsigned32, ro]
- 02 Product number [Unsigned32, ro]
- 03 Revision number [Unsigned32, ro]

1800 PDO1 parameters

PDO1 message is used by default for cyclic transmission of the position value.

See object **6200-00 Cyclic time** to set the cyclic timer.

- 01 COB-ID of PDO1 [Unsigned32, rw]
  If the node address is set using the internal dip-switches (i.e. at least one dip-switch for setting the node has HIGH logic level = 1), when the power is turned on, this object is always forced to the default value. Otherwise, if the node address is set via software (i.e. all dip-switches for setting the node have LOW logic level = 0) it retains the set value, unless a software procedure for setting a new address is forced at power on.
  Default = 4000 0180h+NodeID (no RTR, COB-ID)
- 02 Transmission type [Unsigned8, rw]
  Default = FEh (cyclic transmission)

1801 PDO2 parameters

PDO2 message is used by default for synchronous transmission of the position value.

- 01 COB-ID of the PDO2 [Unsigned32, rw]
  If the node address is set using the internal dip-switches (i.e. at least one dip-switch for setting the node has HIGH logic level = 1), when the power is turned on, this object is always forced to the default value. Otherwise, if the node address is set via software (i.e. all dip-switches for setting the node have LOW logic level = 0) it retains the set value, unless a software procedure for setting a new address is forced at power on.
  Default = 4000 0280h+NodeID (no RTR, COB-ID)
- 02 Transmission type [Unsigned8, rw]
  Default = 01h(synchronous transmission at each SYNC command)
  Position value is transmitted after a set number of SYNC commands.

Interval in SYNC commands must be set in object **1801 PDO2 parameters**, sub 2.

1802 PDO3 parameters

PDO3 message is used by default for synchronous transmission of the position value.

- 01 COB-ID of the PDO3 [Unsigned32, rw]
  If the node address is set using the internal dip-switches (i.e. at least one dip-switch for setting the node has HIGH logic level = 1), when the power is turned on, this object is always forced to the default value. Otherwise, if the node address is set via software (i.e. all dip-switches for setting the node have LOW logic level = 0) it retains the set value, unless a software procedure for setting a new address is forced at power on.
  Default = C000 0380h+NodeID (disable, no RTR)
- 02 Transmission type [Unsigned8, rw]
  Default = 01h (synchronous transmission at each SYNC command).
  Position value is transmitted after a set number of SYNC commands.
  Interval in SYNC commands must be set in object **1802 PDO3 parameters,** sub 2.

1803 PDO4 parameters

PDO4 is used by default for cyclic transmission of the velocity value.
See object **6200-00 Cyclic time** to set the cyclic timer.

- 01 COB-ID of PDO4 [Unsigned32, rw]

  If the node address is set using the internal dip-switches (i.e. at least one dip-switch for setting the node has HIGH logic level = 1), when the power is turned on, this object is always forced to the default value. Otherwise, if the node address is set via software (i.e. all dip-switches for setting the node have LOW logic level = 0) it retains the set value, unless a software procedure for setting a new address is forced at power on.
  Default = C000 0480h+NodeID (no RTR, COB-ID)
- 02 Transmission type [Unsigned8, rw]
  Default = FEh (cyclic transmission)

NOTE
- Transmission of PDO1, PDO2, PDO3 and PDO4 messages can be enabled (or disabled) by setting to "0" (or "1") the most significant bit (MSB) used by PDO (object 180xh, sub1).
- Cyclic transmission or synchronous transmission can be modified by setting the object 180xh sub 2:
  01h: synchronous transmission at each SYNC command;
  02h: synchronous transmission after two SYNC commands;
  …
  FEh: cyclic transmission.

1A00-01 PDO1 mapping parameter

[Unsig32, rw]
This object contains the mapped position value of the encoder according to DS406 device profile.
Default = 6004 0020h

1A01-01 PDO2 mapping parameter

[Unsig32, rw]
See object **1A00-01 PDO1 mapping parameter**

1A02-01 PDO3 mapping parameter

[Unsig32, rw]
See object **1A00-01 PDO1 mapping parameter**

1A03-01 PDO4 mapping parameter

[Unsig32, rw]
This object contains the mapped velocity value of the encoder according to the manufacturer profile.
Default = 3006 0020h

6.8.2 Manufacturer specific objects

2104-00 Limit switch min.

[Unsigned32, rw]
This object can be used to set the lowest software limit switch (-).
If the encoder position is below the value set in this object, bit 12 of object **6500-00 Operating states** will be set to 1.
To enable this function set bit 12 of object **6000-00 Operating parameters** to 1.
Default = 0000 0010h

2105-00 Limit switch max.

[Unsigned32, rw]
This object can be used to set the highest software limit switch. (+).
If the encoder position is higher than the value set in this object, bit 13 of object **6500-00 Operating states** will be set to 1.
To enable this function set bit 13 of object **6000-00 Operating parameters** to 1.
Default = 003F FFF0h

3000-00 Baud rate

[Unsigned8, rw]
This object is meant to set the baud rate (transmission rate) according to the following table:

Data byte	Baud rate
00h	20 Kbit/s
01h	50 Kbit/s
02h	100 Kbit/s
03h	125 Kbit/s
04h	250 Kbit/s
05h	500 Kbit/s (default)
06h	800 Kbit/s
07h	1000 Kbit/s

The bit rate is set through object **3000-00 Baud rate** only if bit 4 in DIP A is set to ”OFF”. If bit 4 in DIP A is set to ”ON”, the bit rate is set by DIP A. For any further information refer to section “4.8 Baud rate: DIP A”.

To change the baud rate value you have to:

- set the object **3000-00 Baud rate**;
- send a Reset node command (or Reset communication command);
- save the parameter;
- set the Master to the new baud rate.

Default = 05h

Master → Encoder

COB-ID	Cmd	Index		Sub	Data byte
600+ID	2F	00	30	00	see table

Encoder → Master (confirmation)

COB-ID	Cmd	Index		Sub	Data byte
580+ID	60	00	30	00	00

Master → Encoder (Reset node)

COB-ID	Cmd	Slave ID
000	81	ID

Set the master device to the new baud rate:

Encoder → Master (Boot-up with new baud rate)

COB-ID	Cmd
700+ID	00

NOTE
To save the new Baud rate value execute the store parameters function (see object **1010-01 Store parameters**).
When the power is turned off, parameters not saved will be lost.

3001-00 Node-ID

[Unsigned8, rw]
This object defines the node identifier of the device.
The node number is set through the object **3001-00 Node-ID** only if all bits of DIP B are set to ”OFF”. If one bit at least of DIP B is set to “ON” the node number is set through DIP B. For any further information refer to “4.9 Node number: DIP B”

To change the Node-ID value you have to:

- set the object **3001-00 Node-ID**;
- send a Reset node command;
- save the parameter.

Default = 01h

Master → Encoder

COB-ID	Cmd	Index		Sub	Data byte
600+ID	2F	01	30	00	new Node-ID

Encoder → Master (confirmation)

COB-ID	Cmd	Index		Sub	Data byte
580+ID	60	01	30	00	00

Master → Encoder (Reset node)

COB-ID	Cmd	Slave ID
000	81	old ID

Encoder → Master (Boot-up with new Node-ID)

COB-ID	Cmd
700+ID	00

NOTE
To save the new Node-ID value execute the store parameters function (see object **1010-01 Store parameters**).
When the power is turned off, parameters not saved will be lost.

3005-00 Velocity format

[Unsigned8, rw]
This attribute defines the engineering units for the velocity value.
00h = steps/s: number of steps per second (default);
01h = rpm: revolutions per minute.

3006-00 Velocity value

[Unsigned32, ro]
This attribute shows the current speed detected by the position sensor and calculated every 100 ms.
Value is transmitted according to the settings in the object **1803 PDO4 parameters**.

6.8.3 Device profile objects (DS 406)

6000-00 Operating parameters

[Unsigned16, rw]

Bit	Function	bit = 0	bit = 1
0	**Code sequence**	CW (clockwise)	CCW (counter clockwise)
1	not used		
2	**Scaling function**	disabled	enabled
3…11	not used		
12	**Limit switch min.**	disabled	enabled
13	**Limit switch max.**	disabled	enabled
14…15	not used		

Default = 0000h

Code sequence

It defines whether the position value output by the transducer increases when the encoder shaft rotates clockwise (CW) or counterclockwise (CCW). When **Errore. L'origine riferimento non è stata trovata.** = 0, the position value increases when the encoder shaft rotates clockwise; on the contrary, when **Code sequence** = 1, the position value increases when the encoder shaft rotates counterclockwise. CW and CCW rotations are viewed from shaft end.

Scaling function

If disabled the device uses its own physical resolution (see objects **6501-00 Hardware counts per revolution** and **6502-00 Hardware number of turns**); if enabled it uses the resolution set in objects **6001-00 Counts per revolution** and **6002-00 Total resolution** with the following relation:Transmitted position =

$$\frac{\textbf{6001-00 Counts per revolution}}{\textbf{6501-00 Hardware counts per revolution}} * \text{real position} \leq \textbf{6002-00 Total resolution}$$

WARNING

Every time you enable the scaling function and/or change the scaling values (see objects **6001-00 Counts per revolution** and **6002-00 Total resolution**) then you are required to set a new preset value (see object **6003-00 Preset value**) and finally save the new parameters (see object **1010-01 Store parameters**).

Limit switch min.Limit switch max.

It allows to enable / disable the function of the objects **2104-00 Limit switch min.** and **2105-00 Limit switch max.**

For further information see on page 29.

6001-00 Counts per revolution

[Unsig32, rw]

This object sets a custom number of distinguishable steps per revolution.
Enabled if bit 2 **Scaling function** in the object **6000-00 Operating parameters** = “1”.

To avoid counting errors, check that

$$\frac{\textbf{6501-00 Hardware counts per revolution}}{\textbf{6001-00 Counts per revolution}} = \text{integer value.}$$

Allowed values are equal to or lower than **6501-00 Hardware counts per revolution** ((see encoder label).

WARNING
Every time you change the value in this object then you are required to set a new preset value (see object **6003-00 Preset value**) and finally save the new parameters (see object **1010-01 Store parameters**).

6002-00 Total resolution

[Unsigned32, rw]
This object sets a custom number of distinguishable steps over the total measuring range.
Enabled if bit 2 **Scaling function** in the object **6000-00 Operating parameters** = ”1”.
Allowed values are equal to or lower than **Total hardware resolution** (**6501-00 Hardware counts per revolution** * **6502-00 Hardware number of turns**, see encoder label).

WARNING
Every time you change the value in this object then you are required to set a new preset value (see object **6003-00 Preset value**) and finally save the new parameters (see object **1010-01 Store parameters**).

Example

Multiturn encoder AMT58-xxx-13x12-CB

Resolution is:

- Hardware counts per revolution: **6501-00 Hardware counts per revolution**= 8192 (2^{13})
- Hardware number of turns: **6502-00 Hardware number of turns** = 4096 (2^{12})
- Total hardware resolution: = 16777216 (2^{24})

2048 counts/rev. ∗ 1024 turns are required:

- Enable scaling function: **6000-00 Operating parameters**, bit 2 = “1”
- Counts per revolution: **6001-00 Counts per revolution** = 2048 (0000 0800h)
- Total resolution: **6002-00 Total resolution** = 2048*1024 = 2097152 (0020 0000h)

NOTE

We suggest values which are power of 2 (2^n: 2, 4, …, 2048, 4096, 8192,…) to be set in the objects **6001-00 Counts per revolution** and **6002-00 Total resolution** to avoid counting errors.

If **6001-00 Counts per revolution** and/or **6002-00 Total resolution** values change, then the **6003-00 Preset value** must be updated to the new resolution. A new **6003-00 Preset value** value is also required.

6003-00 Preset value

[Unsigned32, rw]

This object allows to set the encoder position to a Preset value. Preset function is meant to assign a certain value to a desired physical position of the encoder shaft.

Default = 0000 0000h

NOTE

- If the scaling function is disabled (see bit 2 **Scaling function** in the object **6000-00 Operating parameters**), **6003-00 Preset value** must be lower than “Total hardware resolution” (**6501-00 Hardware counts per revolution * 6502-00 Hardware number of turns**).
- If the scaling function is enabled (see bit 2 **Scaling function** in the object **6000-00 Operating parameters**), **6003-00 Preset value** must be lower than **6002-00 Total resolution**.

6004-00 Position value

[Unsigned32, ro]

This object contains the position value, transmitted value is calculated considering the scaling values. Value is transmitted cyclically or synchronously according to the settings in the objects **1800 PDO1 parameters**, **1801 PDO2 parameters** and **1802 PDO3 parameters**.

6200-00 Cyclic time

[Unsigned16, rw]

Cyclic timer value is used in asynchronous transmission mode to set the interval between two PDO issues. Parameter value is in milliseconds.

Default = 0000h

6500-00 Operating states

[Unsigned16, ro]

Bit	Function	bit = 0	bit = 1
0	**Code sequence**	Clockwise	CCW
1	not used		
2	**Scaling function**	Disabled	Enabled
3…11	not used		
12	**Limit switch min.**	posit. > **2104-00 Limit switch min.**	posit. > **2104-00 Limit switch min.**
13	**Limit switch max.**	posit. < **2105-00 Limit switch max.**	posit. < **2105-00 Limit switch max.**
14	not used		
15	**Current operating state**	Stopped / Pre-operational	Operational

Code sequence

It shows whether the code sequence is set to clockwise (CW) or counterclockwise (CCW). To set the code sequence to either CW or CCW you must set the bit 0 **Code sequence** of the object **6000-00 Operating parameters** to 0 / 1.

Scaling function

It shows whether the scaling function is disabled or enabled. To disable / enable the scaling function you must set the bit 2 **Scaling function** of the object **6000-00 Operating parameters** to 0 / 1.

Limit switch min.

If the encoder position is over the value set in the object **2104-00 Limit switch min.**, bit 12 of this object is set to “0”.
If the encoder position is below the value set in the object **2104-00 Limit switch min.**, bit 12 of this object is set to “1”.
To enable this function set the bit 12 **Limit switch min.** of the object **6000-00 Operating parameters** to "1".

Limit switch max.

If the encoder position is below the value set in the object **2105-00 Limit switch max.**, bit 13 of this object is set to “0”.
If the encoder position is over the value set in the object **2105-00 Limit switch max.**, bit 13 of this object is set to “1”.
To enable this function set the bit 13 **Limit switch max.** of the object **6000-00 Operating parameters** to "1".

Current operating state

It shows the current operating state of the unit. For further information on the available states see “6.2 Operation states”.
bit 15 = 0: Stopped or Pre-operational state;
bit 15 = 1: Operational state.

6501-00 Hardware counts per revolution

[Unsigned32, ro]
This object defines the physical number of distinguishable steps each turn given by the hardware.
To set a custom resolution see object **6001-00 Counts per revolution**

6502-00 Hardware number of turns

[Unsig16, ro]
This object defines the physical number of distinguishable turns given by the hardware.
Total hardware resolution = **6501-00 Hardware counts per revolution** * **6502-00 Hardware number of turns**.
To set a custom number of turns see objects **6001-00 Counts per revolution** and **6002-00 Total resolution**.

6504-00 Supported alarms

[Unsigned16, ro]
Default = 0000h (Alarms not supported).

6506-00 Supported warnings

[Unsigned16, ro]
Default = 0000h (Warnings not supported).6507-00 Profile and software version

[Unsig32, ro]
Contains the profile and software version.

Profile version for encoders = 3.1
Software version = 1.1
Default = 0301 0101h

6508-00 Operating time

[Unsigned32, ro]
Default = FFFF FFFFh (not used)

6509-00 Offset value

[Integer32, ro]
This object contains the Offset value. This value is the difference between the physical position of the encoder and the position relating to the preset value (see object **6003-00 Preset value**).
Default = 0000 0000h

650A-01 Manufacturer offset value

[Integer32, ro]
This object contains the manufacturer offset value. This is the difference between the physical zero position of the encoder (zero set mechanically) and the zero position set by the manufacturer (zero set via software).
Default = 0000 0000h

650B-00 Serial number

[Unsigned32, ro]
Default = FFFF FFFFh (not used)

NOTE
To save new parameters execute the store parameters function (see object **1010-01 Store parameters**).
When the power is turned off or in case of Reset node and Restore node commands, parameters not saved are lost.

6.9 Warning objects

For the complete list and meaning of the warning messages please refer to “SDO abort codes” section in “CiA Draft Standard 301” document available at www.can-cia.org.

6.10 Emergency objects

Emergency (EMCY) objects are issued by the device when an internal error occurs.

EMCY structure:

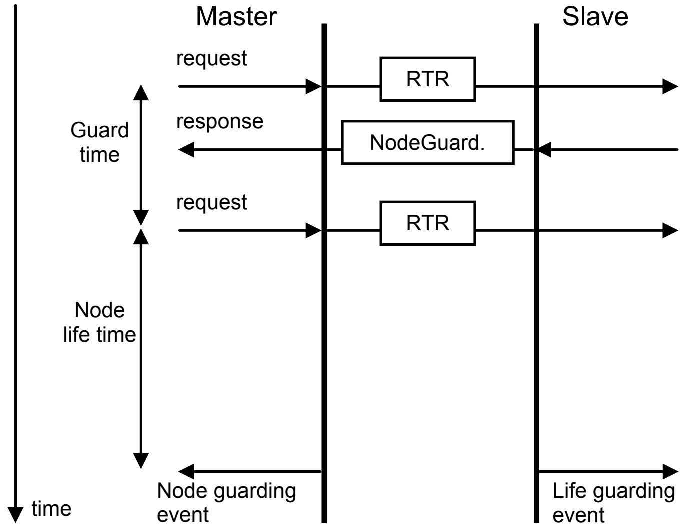
IDENTIFIER
COB-ID(hex)
see object **1014-00 COBID EMCY**

CAN Data Byte			
0	1	2	3…7
Error code		Error Sub-register	Specific code
LSB	MSB	01	00…00

Available error codes:
1000h = Node guarding error
5530h = Flash memory error

6.11 Node guarding protocol

At system boot the “Node guarding protocol” is disabled; this protocol is enabled automatically as soon as the master device sends a RTR message (Remote Transmission Request) the first time.



100C-00 Guard time: interval between two RTR messages.
Node life time: maximum time available for the encoder to receive a RTR message.
Node life time = **100C-00 Guard time * 100D-00 Life time factor**.
“Node guarding” is enabled if **Node life time** * 0.

If the slave does not receive a RTR message before the **Node life time** has expired, it warns activating a “Life Guarding Event”. Furthermore the red LED starts flashing so indicating the Node guarding error, objects **1001-00 Error register** and **1003 Pre-defined error field** are updated and an error message is sent.

To reset the error send a Reset node command.

7. Setting-up

Here following are some examples of transmission between Master and Slave devices.
A generic "ID" value is used to indicate the encoder address; Master address is always 0. All values are expressed in hexadecimal notation.

Set Operational, Pre-operational state

NMT message Master → Slave

	COB-ID	Cmd	Node
Operational:	000	01	ID
Pre-operational:	000	80	ID

Set resolution per revolution 6001-00 Counts per revolution (2_{10}=0000 0400h)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	01	60	00	00	40	00	00

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	01	60	00	00	00	00	00

Set total resolution 6002-00 Total resolution (2_{24}=0100 0000h)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	02	60	00	00	00	00	01

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	02	60	00	00	00	00	00

Set operating parameters 6000-00 Operating parameters (**Code sequence**: CW, **Scaling function**: enabled, **Limit switch min.** / **Limit switch max.**: disabled)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	2B	00	60	00	04	00	-	-

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	00	60	00	00	00	-	-

Set the preset value 6003-00 Preset value (preset = 1000 = 03E8h)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	03	60	00	E8	03	00	00

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	03	60	00	00	00	00	00

Set Sync counter 1801 PDO2 parameters, sub 2 (n = 5 = 05h)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	2F	01	18	02	05	-	-	-

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	01	18	02	00	-	-	-

Disable Sync mode 1801 PDO2 parameters, sub 1
Read COB-ID used by PDO2:

Master → Encoder (Req request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	40	01	18	01	-	-	-	-

Encoder → Master (Req reply)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	43	01	18	01	B0	B1	B2	B3

COB-ID used by PDO2 = ((B3<<24) | (B2<<16) | (B1<<8) | B0)
set the most significant bit to 1:

```
B3 |= 0x80;
```

Set new COB-ID used by PDO2 (**1801 PDO2 parameters**, sub 1):

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	01	18	01	B0	B1	B2	B3

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	01	18	01	00	00	00	00

Enable Cyclic mode
Set cyclic time **6200-00 Cyclic time** (100 ms = 64h)

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	2B	00	62	00	64	00	-	-

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	00	62	00	00	00	-	-

Read COB-ID used by PDO1 (**1800 PDO1 parameters**, sub 1):

Master → Encoder (Req request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	40	00	18	01	-	-	-	-

Encoder → Master (Req reply)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	43	00	18	01	B0	B1	B2	B3

COB-ID used by PDO1 = ((B3<<24) | (B2<<16) | (B1<<8) | B0)
set the most significant bit to 0:

```
B3 &= 0x7F;
```

Set new COB-ID used by PDO1 (**1800 PDO1 parameters**, sub 1):

Master → Encoder (Set request)

COB-ID	Cmd	Index		Sub	Process data			
600+ID	23	00	18	01	B0	B1	B2	B3

Encoder → Master (Set confirmation)

COB-ID	Cmd	Index		Sub	Process data			
580+ID	60	00	18	01	00	00	00	00

NOTE
To save new parameters execute the store parameters function (see object **1010-01 Store parametersErrore. L'origine riferimento non è stata trovata.**).
When the power is turned off or in case of Reset node and Restore node commands, parameters not saved will be lost.

8 – Default parameters list

Default values are expressed in hexadecimal notation.

Parameters list	Default values
1000-00 Device type	0x00010196 0x00020196
1001-00 Error register	0x00
1003 Pre-defined error field -	-
1005-00 COB_ID SYNC message	0x00000080
1008-00 Name of device manufacturer	DATALOGIC AUTOMATION SRL*
1009-00 Hardware version -	-
100A-00 Software version -	-
100C-00 Guard time	0x0000
100D-00 Life time factor	0x00
1014-00 COB-ID EMCY	NODEID+0x00000080
1015-00 Inhibit time EMCY	0x0000
1018 Identification object -	-
1800 PDO1 parameters, sub 1	NODEID+0x40000180
1800 PDO1 parameters, sub 2	0xFE
1801 PDO2 parameters, sub 1	NODEID+0x40000280
1801 PDO2 parameters, sub 2	0x01
1802 PDO3 parameters, sub 1	NODEID+0xC0000380
1802 PDO3 parameters, sub 2	0x01
1803 PDO4 parameters, sub 1	NODEID+0xC0000480
1803 PDO4 parameters, sub 2	0xFE
1A00-01 PDO1 mapping parameter	0x60040020
1A01-01 PDO2 mapping parameter	0x60040020
1A02-01 PDO3 mapping parameter	0x60040020
1A03-01 PDO4 mapping parameter	0x36000020
2104-00 Limit switch min.	0x00000010
2105-00 Limit switch max.	0x003FFFF0
3000-00 Baud rate	0x05
3001-00 Node-ID	0x01
3005-00 Velocity format	0x00
6000-00 Operating parameters	0x0000
6001-00 Counts per revolution –	-
6002-00 Total resolution -	-
6003-00 Preset value	0x00000000
6200-00 Cyclic time	0x0000
6500-00 Operating states	0x0000
6504-00 Supported alarms	0x0000
6506-00 Supported warnings	0x0000
6507-00 Profile and software version	0x03010101
6508-00 Operating time	0xFFFFFFFF
6509-00 Offset value	0x00000000
650A-01 Manufacturer offset value	0x00000000
650B-00 Serial number	0xFFFFFFFF

* Text string