CET s.r.l.

CAM

PROGRAMMER

MCA 116

User manual

Version 1.00

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INDEX

1. GENERAL DESCRIPTION

1.1. INTRODUCTION

The CAM PROGRAMMER is an electronic device designed to carry out controls strictly connected with determined positions in the space. The device is designed to work with machines having cyclic operations that can be coupled with a full revolution of a shaft; in particular the workspace is represented by the 360 turns angle.
The device is suitable to replace the mechanical CAMS now in use in many sectors of handling and checked realization in the space.
The device after all the advantages typical of the electronic control devices as lack of members in motion, high precision and repeatability, easy setting by means of programming, more dependability and performances,
The CAM PROGRAMMER, practically, can be comparative with the mechanical CAMS for the similarities of use, as ft Is a sophisticated Instrument, which can be connected with machines having a high technological features as multifunction automatic presses or packaging machines, in the device the angular position of the operation cycle is taken at high speed by a precision ABSOLUTE ENCODER.
The CAM PROGRAMMER uses the encoder data, processes them according to preset functions and makes available in output in real time, all the programmed PROFILES (PHASES), suitably advanced in function of the speed.
500 r.p.m. speed, multiple cams with I degree resolution, independent and regular advances in the acceleration and deceleration ramps, modular architecture with 2, possibility to visualize alarm messages, are a few of the distinctive features of the device.

1.2. NOMENCLATURE USED

ELECTRONIC CAM PROGRAMMER
Programmable electronic device with substitutive operation to the mechanical CAMS

CAM:
Withthistermofmechanicaiderivationismeanteachsinglelineofoperation (OUTPUT) that carries out the function to generate ON - OFF controls according to a programmed sequence.

PHASE:
It represents the single action between an ON and an OFF that composes a CAM. Every CAM can consist from 1 to " n " PHASES.

MULTIPLE CAM:
Multiple is called every CAM containing more than 1 PHASE.

FORMATS:
They represent the various programs preset for every CAM or CHANNEL.

CHANNEL:
It represents a set of CAMS subject to common rules or with common features. In the CAM PROGRAMMER every CHANNEL consist of 8 CAMS.

ADVANCE:
Value in time used to advance 1 output action (PHASE) in the space in function of the speed.

1.3. GENERAL FEATURES

- OUTPUT UP TO 16 CAMS ORGANIZED IN 2 INDEPENDENT CHANNELS OF 8 CAMS EACH
- INPUTS FOR ABSOLUTE ENCODER FOR SIZES ON TURNS ANGLE WITH ONE DEGREE OF RESOLUTION
- PROGRAMMING POSSIBILITIES OF 180 PHASES FOR EVERY CAM (180 ON AND 180 OFF FOR MULTIPLE CAMS)
- AVAILABILITY OF 16 INDEPENDENT FORMATS FOR EVERY CHANNEL
- ELECTRIC ZERO FOR THE ENCODER PROGRAMMABLE BY MEANS OF INSERTION OF AN OFFSET VALUE TO MAKE UP FOR PHASE DIFFERENCE
- ELECTRICAL DIRECTION OF ROTATION OF PROGRAMMABLE ENCODER (FOR 720 ENCODER ONLY IMPULSE PER ROUND)
- LINEAR AUTOMATIC ADVANCE OF SIGNAL ON THE OUTPUTS IN FUNCTION OF THE SPEED WITH VALUE (in time) PROGRAMMABLE AT CHANNEL LEVEL (FOR 720 ENCODER ONLY IMPULSE PER ROUND)
- HIGHEST ENCODER SPEED: 500 R.P.M.
- SIGNAL OF ENCODER AT A STANDSTILL
- 16 MESSAGES OF 20 CHARACTERS EACH FREELY PROGRAMMABLE ASSOCIATED WITH THE 16 CAMS FOR THEIR IDENTIFICATION
- 63 ALARM MESSAGES OF 20 CHARACTERS EACH FREELY PROGRAMMABLE THAT CAN BE RECALLED ON DISPLAY BY MEANS OF SPECIAL CONTROLS FROM PLC
- AVAILABILITY OF SERIAL LINE RS 232 FOR EXCHANGE OF INFORMATION OR FOR PROGRAMMING FROM PERSONAL COMPUTER OR FROM OTHER CAM PROGRAMMERS
- POSSIBILITY TO DISPLAY AND PROGRAMMING ALL THE DATA, PARAMETERS AND FUNCTIONS BY MEANS OF SPECIAL DIGITAL FUNCTION KEYBOARD ON THE FRONT VIEW OF THE DEVICE
- GUIDED PROGRAMMING WITH MENU THAT CAN BE SELECTED IN 5 LANGUAGES

1.4. TECHNICAL FEATURES

CONTROL UNITS	
POWER	: 24 Vdc +10% -10%
CONSUMPTION	: 200 mA
CLIMATIC CONDITIONS	: R.H. 95 % AT 40 °C (with no condensate).
SERIAL LINE 1	: Type RS232 / FULL DUPLEX WITH READY / BUSY 8 BIT DATA / PARITY NONE / 1 STOP BIT / SPEED 1200 BAUD /ASYNCHRONOUS.

FRONT VIEW OF DEVICE	
LED VISUALIZATION	: 16 high efficiency led to emphasize the **ON** and the **OFF** of the 16 cams outputs.
LCD VISUALIZATION	: Liquid crystal alphanumerical display with 2x20 characters lines each, 5 mm high (type STN, visible from any angle). It visualizes the encoder speed, the most important parameters and the alarm messages; during programming it shows the menu for the operator.
KEYBOARD	: 14 mechanical keys under membrane with digital functional composition for all the programming and visualization operations. Any access to the device from the front view is protected by password.
PROTECTION	: The front view of the device has a "IP65" protection degree.

INPUT AND OUTPUT CHANNEL	
AUXILIARY POWER FOR INPUTS AND	: 24 Vdc + 10 % - 10 % (to be supplied to instrument) Residual ripple 1 Vpp (input 300 mA max for the ENCODER with outputs OFF).
INPUT FROM ENCODER	: 10 NPN inputs (8 mA) for encoder 720/360/255 pulses - revolution codified in binary or gray.
OUTPUT FOR ENCODER	: 1 PNP output for direction control of electrical rotation (for 720 impuls encoder only).
INPUT FROM PLC	: 8 inputs (4 mA) for every channel NPN or PNP programmable for selection of formats and alarm recall.
CAMS OUTPUTS	: 8 outputs for every channel max 16 in PNP 24 Vdc with capacity of 100 mA each and max 500 mA for channel (60mA each).

1.5. DESCRIPTION OF ARCHITECTURE

The CAM PROGRAMMER is a substitutive device of the mechanical cams with considerable capacity: 16 outputs (CAMS) and of easy programming and used. It is programmable with its own keys on the front view or, through its serial line, both by personal computer and by terminal master or by a sample device. The instrument consists of a control base unit, of a peripheral unit for visualization and of intelligent input output peripheral.
The base unit contains all the essential control functions of the device and furthermore it controls the accessory functions as MENUS, TEXTS and serial lines.
The visualization peripheral, that also belong the front view keyboard for data introduction to, consists of a alphanumerical LCD display with 2 lines of 20 characters and of 16 punctiform LEDs.
The LCD display is used for exchange of information with the operator during all the programming and operation phases of the machine. During programming it is possible to see the various MENUS running, during normal operation the speed data per channel, the alarm messages and the angular position in degrees of encoders (from 0 to 360) are visualized for every channel and the formats necessary for operation.
The 16 LEDS show the ON / OFF state of every single CAM in output.
The peripheral INPUT / OUTPUT are intelligent units with self-control of encoders and of outputs; from the base unit they receive the operation parameters and the programming data only.
All the programmed data are in fully static stores, type EEPROM.

1.6. DESCRIPTION OF FUNCTIONS

The device has a certain number of parameters, features and programmable operating modalities that have been grouped under the name of FUNCTIONS:

1) FORMAT SELECTION
2) HIGHEST SPEED
3) ADVANCE SELECTION
4) OFFSET SELECTION
5) SELECTION OF LANGUAGE
6) SERIAL TRANSMISSION
7) DIAGNOSTIC
8) BEEP

NOTE
Before using the device CAM PROGRAMMER, all the functions shall be carefully programmed.

1.6.1. SELECTION OF FORMAT

For FORMAT is meant a complete program of operation for a set of CAMS. The CAM PROGRAMMER has 16 FORMATS, independent for every CHANNEL; furthermore such programs can be preset and varied directly from keyboard by programming the number wanted to be utilized in the function of SELECTION OF FORMAT for every channel.
The FORMAT relative to a determinate channel contains therefore the programming of all the PHASES for the 8 respective CAMS in compliance with the schedule (for the highest capacity) here - below:

		CHANNEL x	**FORMAT yy**		
PHASE	**CAM 1**	**CAM 2**	**CAM x**	**CAM x**	**CAM 8**
phase 001	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 002	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 003	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 004	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 005	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 179	zzz-sss	zzz-sss	…….	…….	zzz-sss
phase 180	zzz-sss	zzz-sss	…….	…….	zzz-sss

Where:
x = from 1 to 2 (number of channel)
yy = from 1 to 16 (number of format)
zzz = value in degrees of ON point (from 0 to 360)
sss = value in degrees of OFF point (from 0 to 360)

1.6.2. HIGHEST SPEED

The speed parameter represents a safety value for operation as it is on its ground the highest advance value admitted in programming is calculated. The menu makes it possible to select speeds independent for every channel
See schedule here - below:

1.6.2.1. Schedule of advance speeds

REFERENCE BETWEEN HIGHEST SPEED PRESET AND HIGHEST ADVANCE THAT CAN BE PRESET

SPEED (r.p.m.)	ADVANCE (mSec.)
410	100
420	99
430	97
440	95
450	93
460	91
470	89
480	87
490	85
500	84

1.6.3. ADVANCE SELECTION

The advance parameter is a value in time (milliseconds) that can be preset in an independent way in 2 CHANNELS.
The ADVANCE used in the CAM PROGRAMMER represent a value in time destined to make up for a mechanical constant lag in the execution of an electrical control on the system.
The electrical control is generated in real time in correspondence of a right determinate physical position of a member in motion.
The CAM PROGRAMMER utilized as a reference the SPACE (O - 359) but not the time, and therefore an advance in time shall be turned (transformed in function of the speed, into SPACE). The formula used is the classical one:

v = s x t (velocity = space by time)
from which **s = v / t** is obtained (space = velocity divided time).

It is a linear ratio and therefore the advance obtained is defined **LINEAR ADVANCE**.

EXAMPLE

- Supposing to have a realization member (organ) in which the lag between the electric signal applied and the mechanical execution of the control is 100 msec.

- Supposing it should be necessary that the control is carried out in the position relative to degree 300 of the encoder and always in that position, irrespective of the machine speed and therefore from the encoder. To obtain that, it is clear that the CAM PROGRAMMER will have to generate the electrical control in different position of the encoder in function of the different speeds. By presetting an **ADVANCE** equal to **100 mSec**, we will obtain:

for - **ENCODER SPEED = 1** degree for every millisecond (180 r.p.m. the electric control will be generated in the correspondence of the degree 200 (as, after 100 msec, the encoder wiII be in the position 300, as at speed of 1 degrees millisecond, 100 msec. correspond to 100 degrees

for - **ENCODER SPEED = 0,5** degrees / millisecond (90 r.p.m. the electric control will be generated in the correspondence of the degree 250 (as, after 100 msec, the encoder will be in the position 300, as at speed of 0,5 degrees millisecond, 100 msec. correspond to 50 degrees),

for - **ENCODER SPEED = 0,1** degrees / millisecond (18 r.p.m. the electric control will be generated in the correspondence of the degree 290 (as, after 100 msec, the encoder will be in the position 300, as at speed of 0,1 degrees / millisecond, 100 msec. correspond to 10 degrees).

The CAM PROGRAMMER, according to the advance programmed in time, calculates continuously, in function of the speed, how much the ADVANCE IN SPACE to be considered and keeps (on the ground of the result) always up - to - date the output (CAMS) up to an encoder speed of 500 REVOLUTION p.m.

The highest advance in TIME is of 100mSec.

The highest advance in SPACE that can be calculated in function of the speed is 255 DEGREES.

It is possible to consider advances of non-linear types, obtained from quadratic ratios or from tabulated correspondences. The CAM PROGRAMMER is always referred to linear advances inserted automatically, though ft is potentially in a position to handle any other type of advance.

1.6.4. OFFSET SELECTION

By means of this parameter (value in degrees between 0 - 359), it is possible to program an electrical position of ZERO ENCODER, different from its real position of MECHANICAL ZERO.
With this simple contrivance it is possible to set to zero the position of the machine without mechanical intervention on the encoder.

It, for example, with OFFSET = 0 and with the machine in position 0, the display of the CAM PROGRAMMER show the position 150 degrees, to obtain the display of 0, it will be necessary to insert an OFFSET of 210 degrees, as 150 + 210 = 360 degrees, viz: 0 degrees.

1.6.5. SELECTION OF LANGUAGE

The CAM PROGRAMMER show on the display LCD a MENU as a guide to programming; with the function SELECTION OF LANGUAGE 1 it is possible to visualize such a menu in five different languages

- ITALIAN
- ENGLISH
- GERMAN
- FRENCH
- SPANISH

1.6.6. ENCODER ROTATION DIRECTION

To change the rotation direction of the encoder connect the DIR input with -VE (GND) or with +VE (+24Vdc), for the right direction, on the interface card for the 255 inpuls encoder use the 2^9 input instead of the DIR input.

1.6.7. SERIAL TRANSMISSION

Under this function are grouped a series of controls of general utility, that are accessible through the following under menus:

1 TRANSMISSION OF FORMATS
2 TRANSMISSION OF TEXTS
3 PRINTING OF FORMATS
4 PRINTING OF TEXTS

All the types of transmission refer to the control in TX of the serial line RS232 to a personal computer (MS-DOS or compatible).

The Personal shall have at its disposal a special APPLICABLE SOFTWARE "PCCAM" supplied by CET and as a kit to instruments.
The transmissions can be utilized for data file or for modification or programming.

- With TRANSMISSION OF FORMATS are transferred to the personal all the programming of the PHASES of all the CHANNELS and of all the FORMATS present inside the CAM PROGRAMMER.

- With TRANSMISSION OF TEXTS are sent the programming wordings available for the CAMS (up to 16) as well as the texts for the ALARMS.

- With TRANSMISSION OF THE FUNCTIONS are sent all the inner programming relative to the FUNCTIONS (operation directions and parameters of the device).

- The PRINTING options can be used to send in serial line (RS232), to a PRINTER, the inner data to the device.

The format (protocol) is of the standard type with LF after 40 CHARACTERS; therefore, beside the printer CET type ST40, can be utilized also other commercial type in RS232.

1.6.8. DIAGNOSTIC

It represents a function of utility for the test and the setting at work of the system. Two different types of TESTS can be selected:

- INPUTS TEST
- OUTPUTS TEST

The former shows on the front leds the situation present in the input from PLC of every channel.
The latter starts sequentially all the outputs of the channels, by visualizing the datum on the corresponding front leds.

1.6.9. BEEP

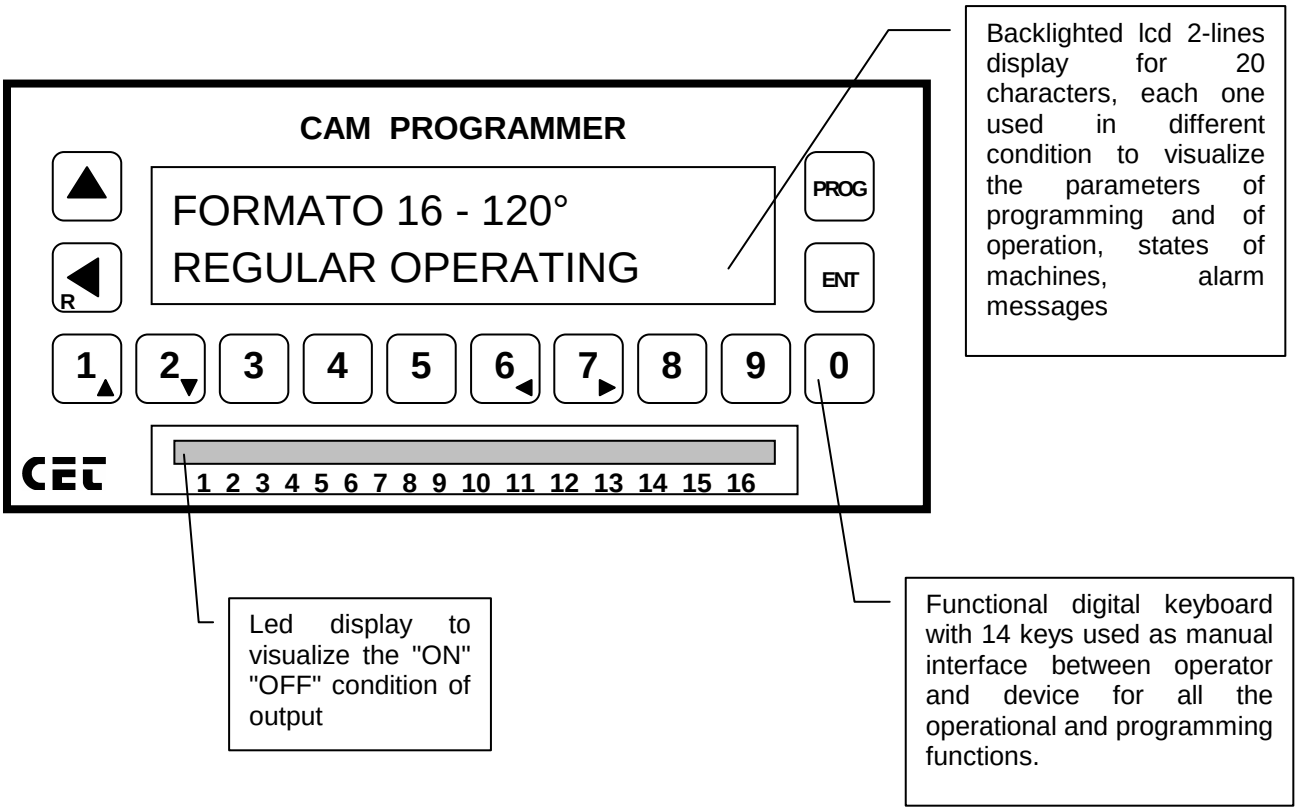
The CAM PROGRAMMER is equipped with a sound signal ' BEEP " used in different conditions.
Such a function makes it possible to the user to select *BEEP ON " or a BEEP OFF 0, viz.: exclusion or enabling of sound signal.

NOTE

The CAM PROGRAMMER has also a further particular function, which can be used with own access code;
It is the ENCODER SIMULATION.
Such as opportunity makes it possible to verify the programmed cams, without using directly the encoder, but simply an inner meter that carries out its simulation with two different advancement speeds,

2. FUNCTIONAL DESCRIPTION

2.1. FRONT DESCRIPTION



The device converses with the operator by means of the indications visualized on the FRONT VIEW and maim it possible to program all its functions by means of its keys.

VISUALIZATION OF OPERATION VALUES
VISUALIZATION OF PROGRAMMED CAMS
PROGRAMMING OF CAMS
PROGRAMMING OF FUNCTIONS OR PARAMETERS
INNER OR OUTER DIAGNOSTICS

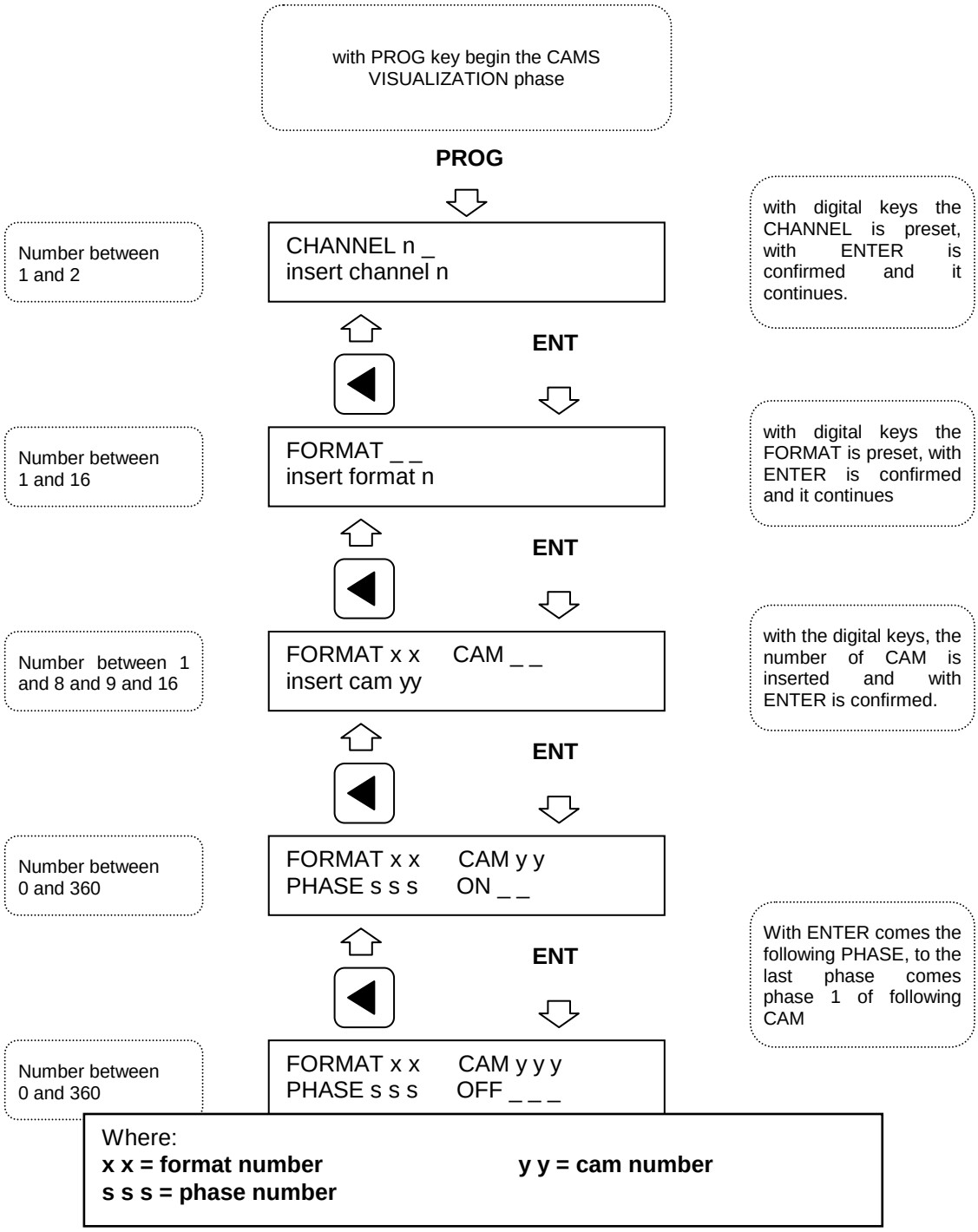
The first operation is carried out during the normal working
The data presented by operator are:

- **ENCODER SPEED** in r.p.m.
- **ALARM MESSAGE** if it is present it is visualized on the second line.
- **ANGULAR POSITION OF THE ENCODER** On the LCD display and from 0 to 359 degrees.
- **PRESENT PROGRAM IN FUNCTION** On the LCD display (from 1 to 16).
- **ON - OFF OF OUTPUT CAMS** emphasized with special LEDs.

2.2. PROGRAMMING

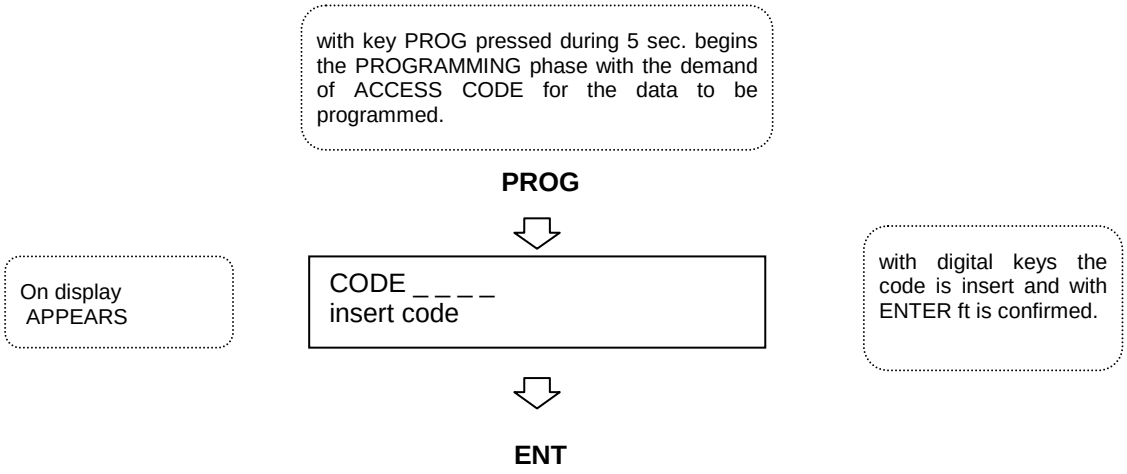
The Cams of the CAM PROGRAMMER can be always programmed by the front keys or serial line.
Its possible to change formats in every moment by front keys, by serial line or by parallel recall from PLC.
After any new setting it's necessary to change or confirm the format the new program takes 6 seconds to be transfer to the peripheral output.
The programming practices are shown in the following pages.

2.2.1. DIRECTIONS OF VISUALIZATION



To quit the programs visualization push the PRG Key.

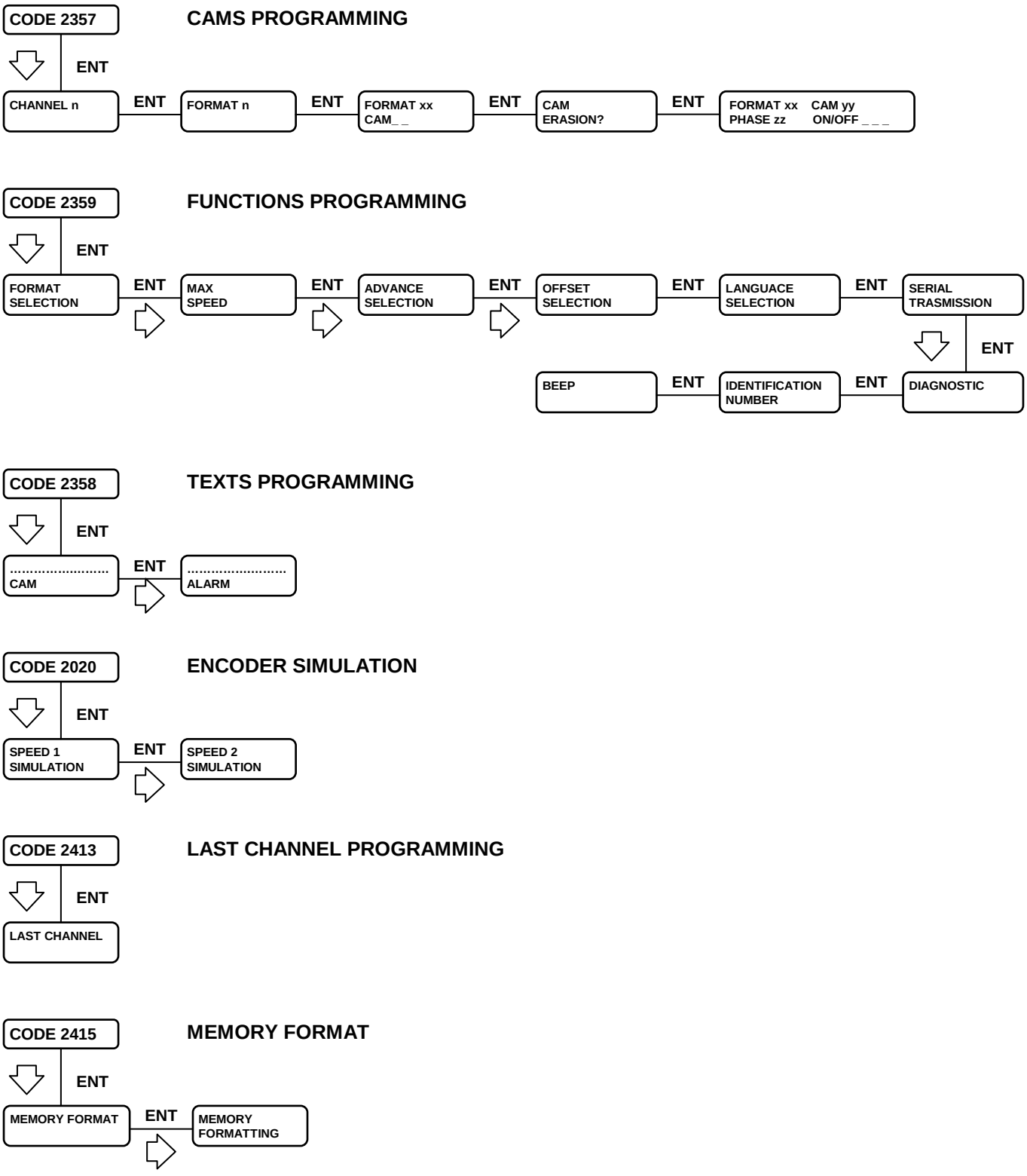
2.2.2. DIRECTION OF PROGRAMMING



In function of the access code, which will be used, continue in the corresponding menu:

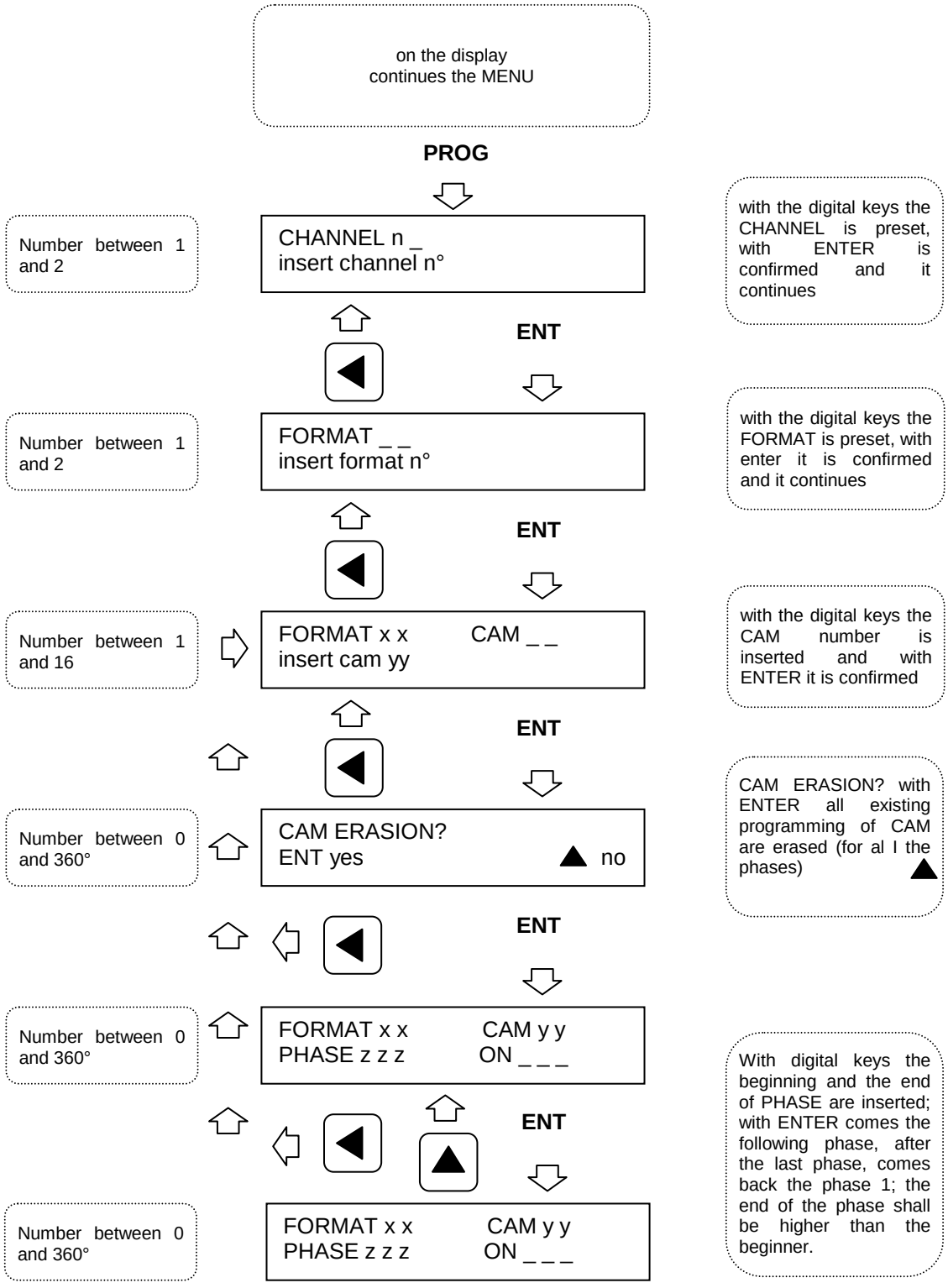
CAMS PROGRAMMING:	**2357**
FUNCTIONS PROGRAMMING:	**2359**
TEXTS PROGRAMMING:	**2358**
ENCODER SIMULATION:	**2020**
LAST CHANNEL PROGRAMMING:	
2413	

2.2.3. GENERAL MENU OF PROGRAMMING



2.2.4. CAMS PROGRAMMING

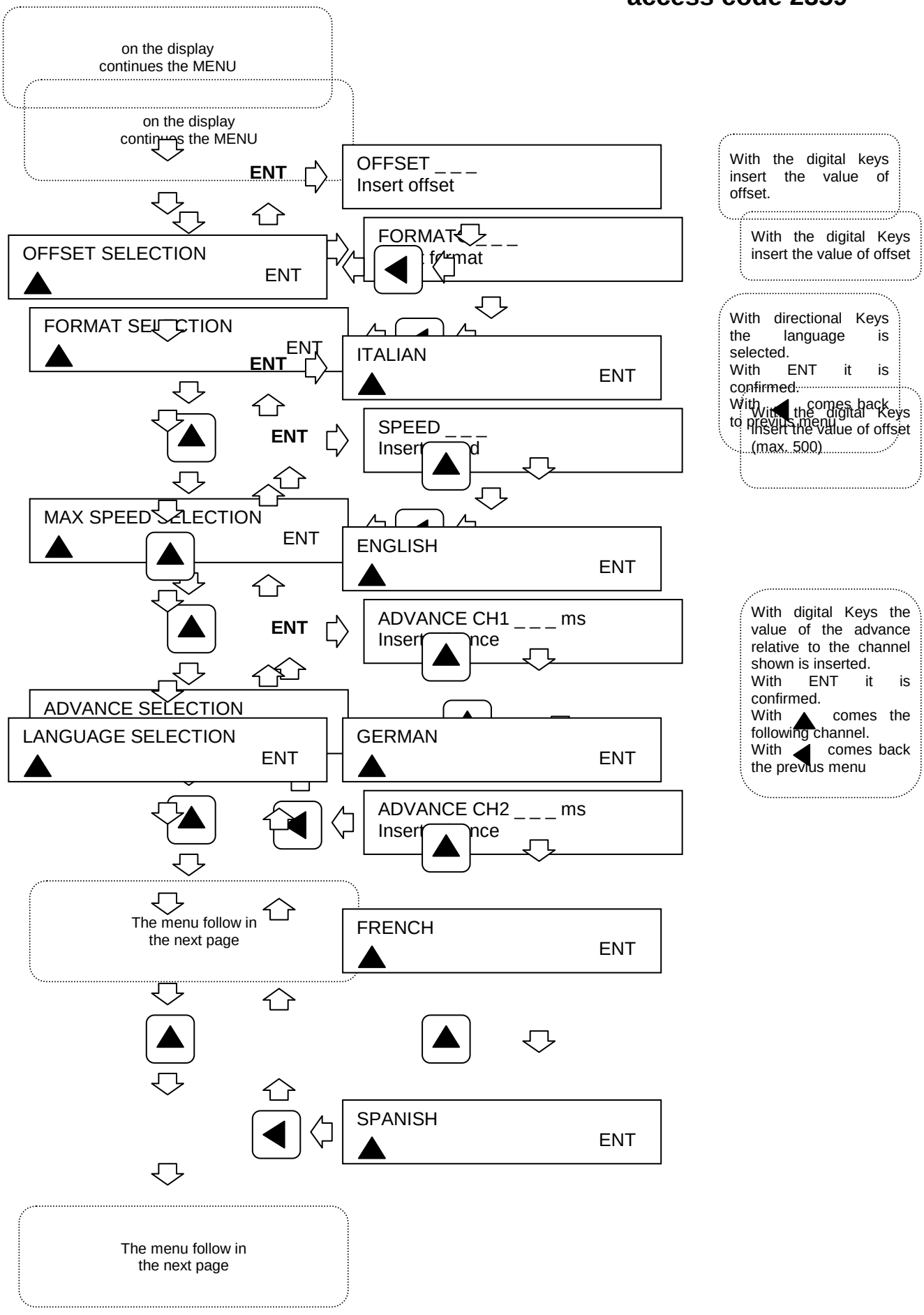
access code 2357

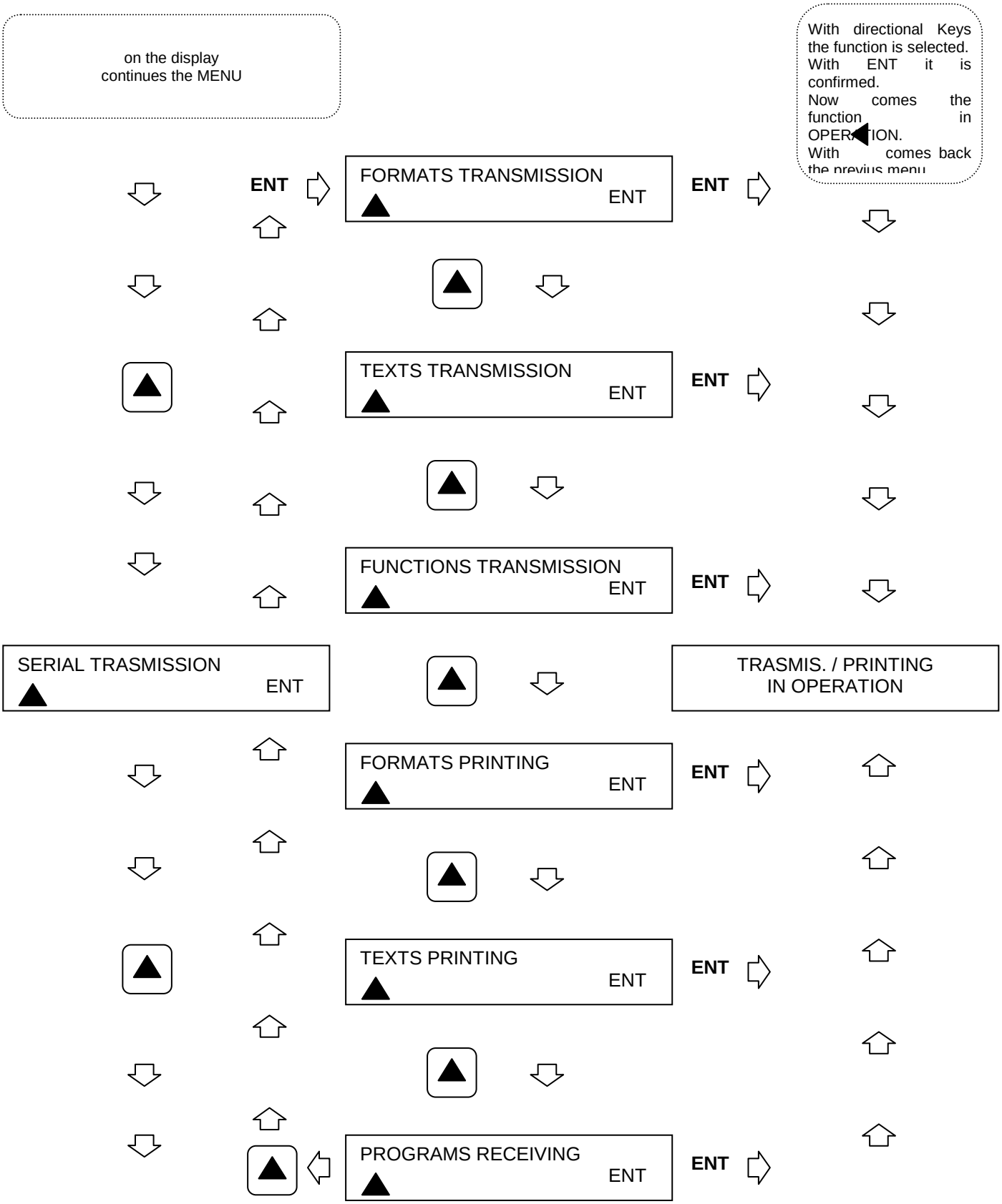


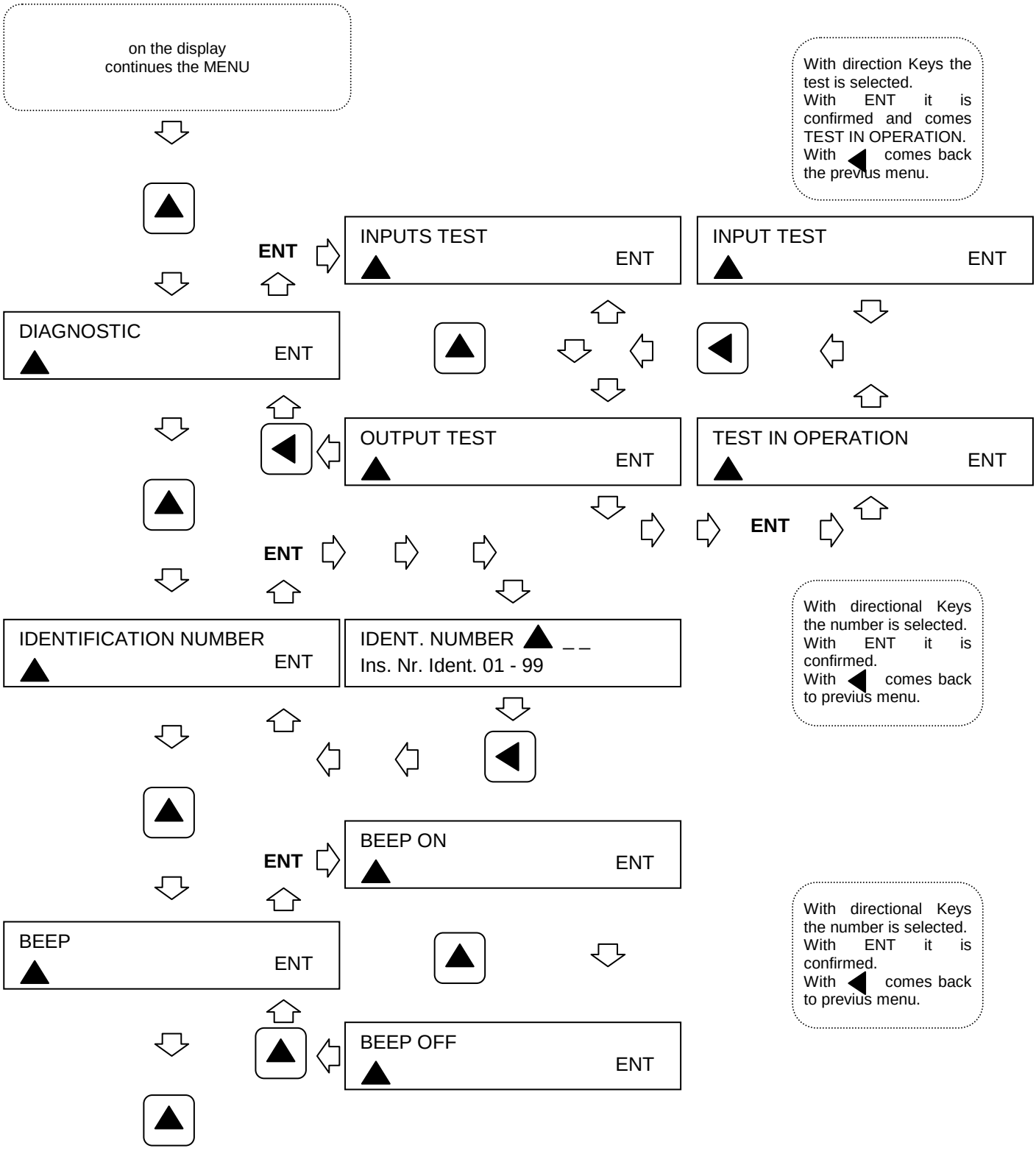
Where:
x x = FORMAT **y y = CAM** **s s s = PHASE**

2.2.5. FUNCTIONS PROGRAMMING

access code 2359

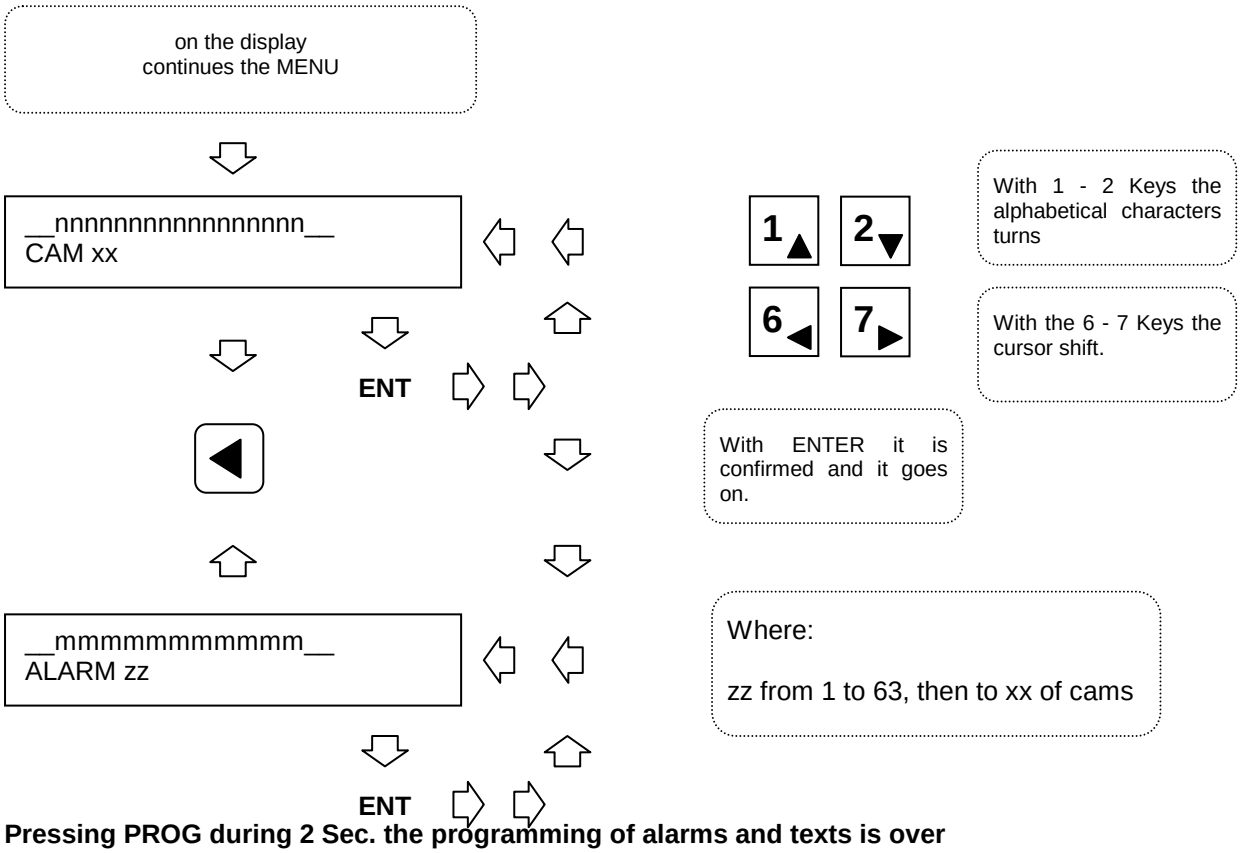



on the display
continues the MENU
With directional Keys the function is selected.
With ENT it is confirmed.
Now comes the function in OPERATION.
With comes back the previus menu
ENT
FORMATS TRANSMISSION
ENT
ENT
TEXTS TRANSMISSION
ENT
ENT
FUNCTIONS TRANSMISSION
ENT
ENT
SERIAL TRASMISSION
ENT
TRASMIS. / PRINTING
IN OPERATION
FORMATS PRINTING
ENT
ENT
TEXTS PRINTING
ENT
ENT
PROGRAMS RECEIVING
ENT
ENT
The menu follow in
the next page


on the display
continues the MENU
With direction Keys the test is selected.
With ENT it is confirmed and comes TEST IN OPERATION.
With ◀ comes back the previus menu.
ENT
INPUTS TEST
ENT
INPUT TEST
ENT
DIAGNOSTIC
ENT
OUTPUT TEST
ENT
TEST IN OPERATION
ENT
ENT
ENT
With directional Keys the number is selected.
With ENT it is confirmed.
With ◀ comes back to previus menu.
IDENTIFICATION NUMBER
ENT
IDENT. NUMBER _ _
Ins. Nr. Ident. 01 - 99
ENT
BEEP ON
ENT
With directional Keys the number is selected.
With ENT it is confirmed.
With ◀ comes back to previus menu.
BEEP
ENT
BEEP OFF
ENT

2.2.6. TEXTS PROGRAMMING

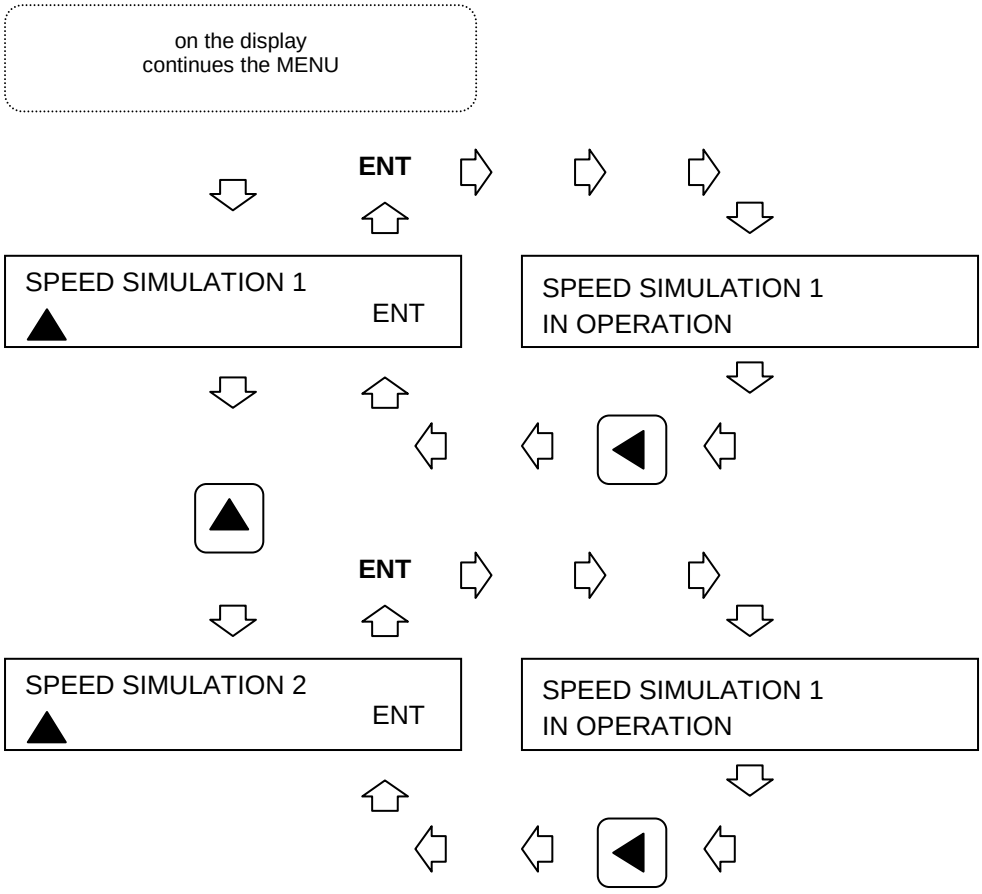
access code 2358



Pressing PROG during 2 Sec. the programming of alarms and texts is over

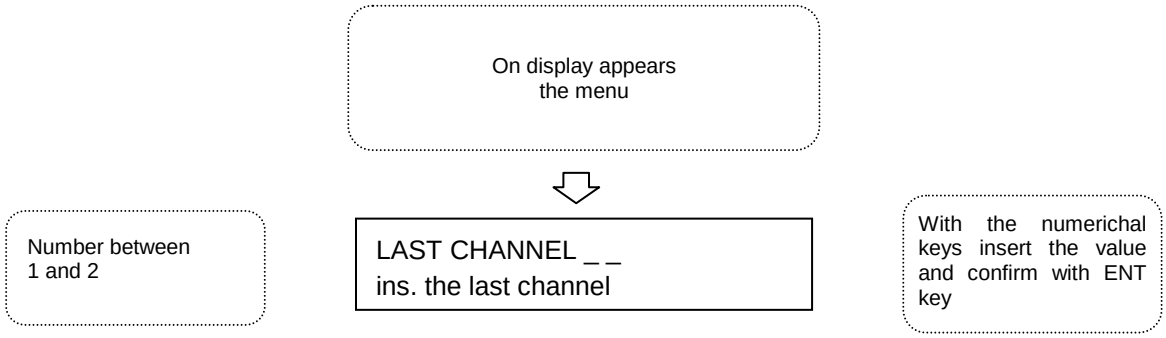
2.2.7. ENCODER SIMULATION

access code 2020



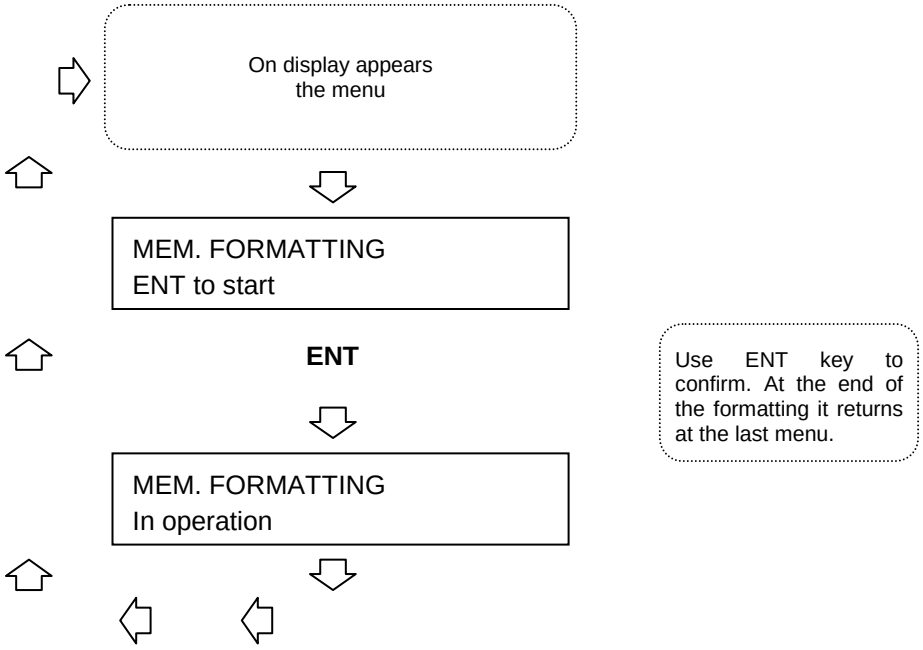
2.2.8. LAST CHANNEL PROGRAMMING

access code 2413



2.2.9. MEMORY FORMATTING

access code 2415



3. TECHNICAL DESCRIPTIONS

3.1. ENCODER

ABSOLUTE ENCODER - 720pulses / revolution

- **BINARY CODING**
- **NPN Open Collector (40 - 80 mA) output**
- **Feed 18 - 28 Vdc**
- **Absorption 300 mA**
- **Input in Positive Logic 28 Vdc for reversal remote control of electric direction of rotation**

"OFF" = CLOCKWISE "ON" = ANTICLOCKWISE

ABSOLUTE ENCODER - 360pulses / revolution

- **BINARY CODING**
- **NPN Open Collector (40 - 80 mA) output**
- **Feed 18 - 28 Vdc**
- **Absorption 300 mA**

ABSOLUTE ENCODER - 255pulses / revolution

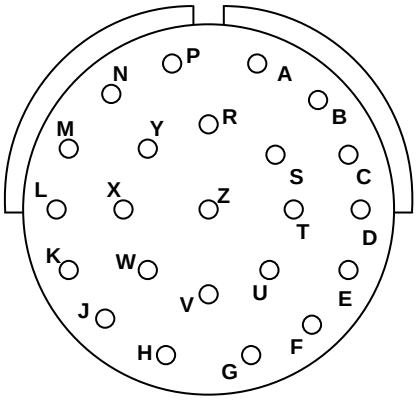
- **BINARY CODING**
- **NPN Open Collector (40 - 80 mA) output**
- **Feed 18 - 28 Vdc**
- **Absorption 300 mA**

3.1.1. RECOMMENDED ENCODER

LIKA	**AST672/BN - 10R/S100** **AST672/BN - 10W/S101**	**CIRCULAR CANNON** **CANNON**
SICOD	**XZ90/720B/18-28/KK**	**CANNON**
TEKEL	**TKC50/F/720B/11-30/10D/13/U**	**CANNON**
OMRON	**E6CP-AG5C-C** **E6F-AG5C-C**	**CANNON** **CANNON**

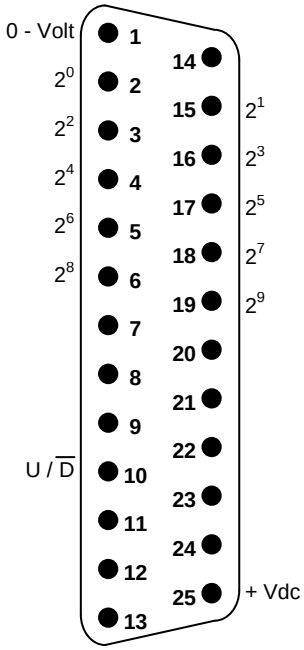
3.1.1.1. SCHEME OF ENCODERS CONNECTORS

TKC CONNECTOR MS 23

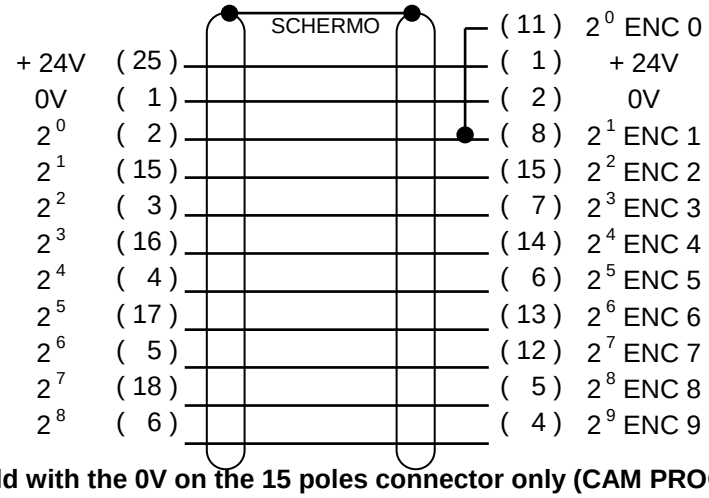


PIN	SIGN	PIN	SIGN	PIN	SIGN
A	2^0	F	2^5	W	U / $\overline{D}$
B	2^1	G	2^6	Y	+ Vdc
C	2^2	H	2^7	Z	0 Volt
D	2^3	J	2^8	—	
E	2^4	K	2^9	—	

TKC CONNECTOR DE 25P

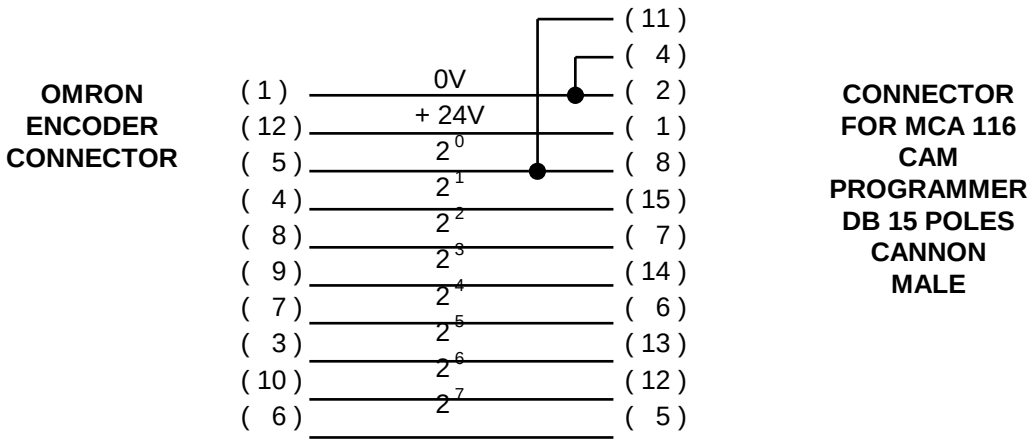


3.1.1.2. CONNECTION SCHEME OF AST636/BN10W/S101 LIKA ENCODER WITH 360 IMP PER ROUND



N. B. : Connect the shield with the 0V on the 15 poles connector only (CAM PROGRAMMER)

3.1.1.3. CONNECTION SCHEME OF EGCP-AG5C-C OMRON ENCODER WITH 255 IMP PER ROUND



3.1.2. TABLE OF THE ANGULAR VALUES WITH 256 DIVISIONS PER ROUND

To make easy the programmation, the visualizations and the entering can be executed using the following table.

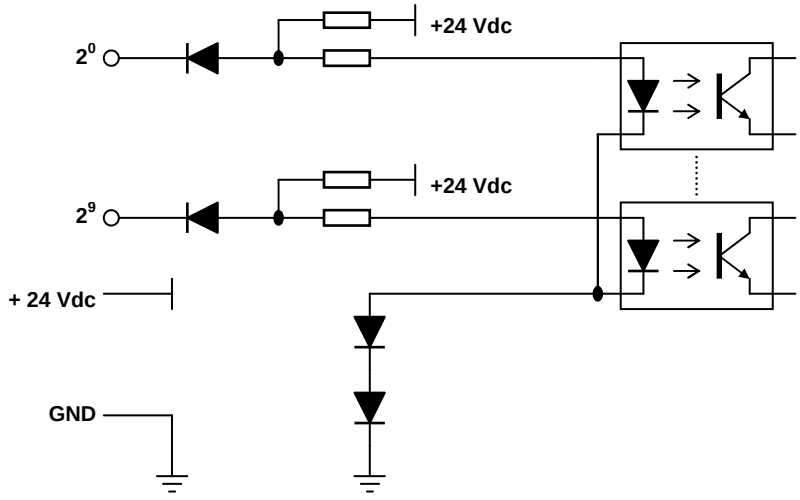
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0°	1°	3°	4°	6°	7°	8°	10°	11°	13°	14°	15°	17°	18°	20	°	21°
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
23°	24°	25°	27°	28°	30°	31°	32°	34°	35°	37°	38°	39°		41°	42°	44°
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
45°	46°	48°	49°	51°	52°	53°	55°	56°	58°	59°	60°	62°		63°	65°	66°
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
68°	69°	70°	72°	73°	75°	76°	77°	79°	80°	82°	83°	84°		86°	87°	89°
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
90°	91°	93°	94°	96°	97°	98°	100°	101°	103°	104°	105	°	107°	108°	110°	111°
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
113°	114°	115°	117°	118°	120°	121°	122°	124°	125°	1	27°	128°	129°	131°	132°	134°
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
135°	136°	138°	139°	141°	142°	143°	145°	146°	148°	1	49°	150°	152°	153°	155°	156°
112	113	114	115	116	117	118	119	120	121	121	123	124	125	126	127
158°	159°	160°	162°	163°	165°	166°	167°	169°	170°	1	72°	173°	174°	176°	177°	179°
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
180°	181°	183°	184°	186°	187°	188°	190°	191°	193°	1	94°	195°	197°	198°	200°	201°
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
203°	204°	205°	207°	208°	210°	211°	212°	214°	215°	2	17°	218°	219°	221°	222°	224°
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
225°	226°	228°	229°	231°	232°	233°	235°	236°	238°	2	39°	240°	242°	243°	245°	246°
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
248°	249°	250°	252°	253°	255°	256°	257°	259°	260°	2	62°	263°	264°	266°	267°	269°
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
270°	271°	273°	274°	276°	277°	278°	280°	281°	283°	2	84°	285°	287°	288°	290°	291°
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
293°	294°	295°	297°	298°	300°	301°	302°	304°	305°	3	07°	308°	309°	311°	312°	314°
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
315°	316°	318°	319°	321°	322°	323°	325°	326°	328°	3	29°	330°	332°	333°	335°	336°
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
338°	339°	340°	342°	343°	345°	346°	347°	349°	350°	3	52°	353°	354°	356°	357°	359°

How to use the table

0	1	
0°	1°	
16	17	
23°	24°	

← Visualization 256 (data in output of the encoder)
← Visualization 360°(data converted in 360°)

3.1.3. INPUTS FROM ENCODER



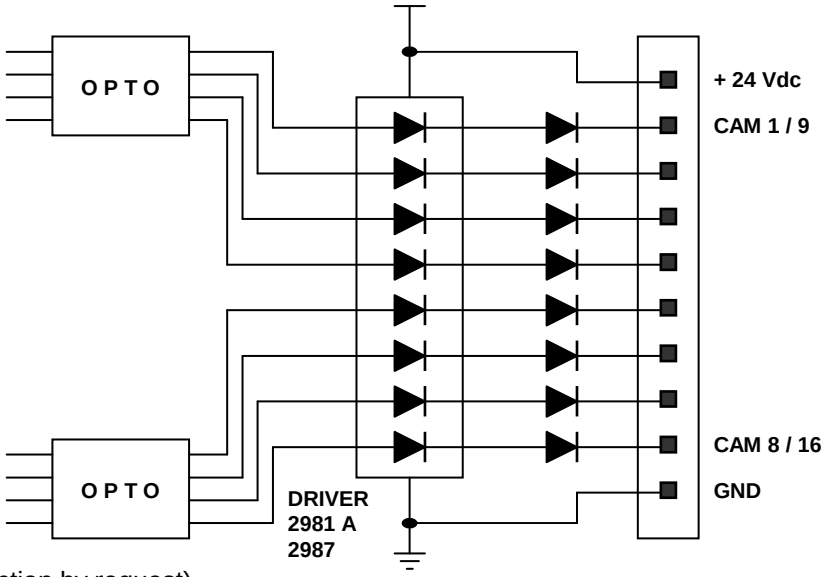
3.2. CAMS

The output controls for CAMS are realized in POSITIVE logic 24 Vdc by using the SPRAGUE integrated type 2981A

max parameters utilizable for a group of 8 outputs: 30 Vdc / 60mA

max parameters utilizable for every output: 30 Vcc / 100 mA up to 500mA max (5 active ouputs)

3.2.1. OUTPUTS CONFIGURATIONS AND CONNECTIONS

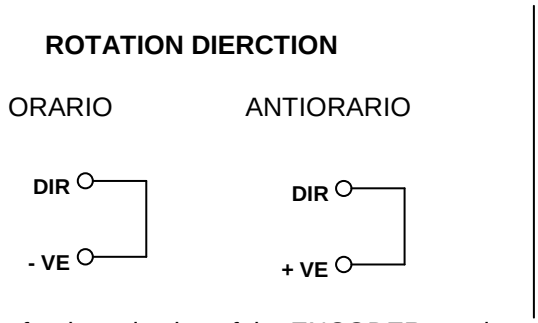


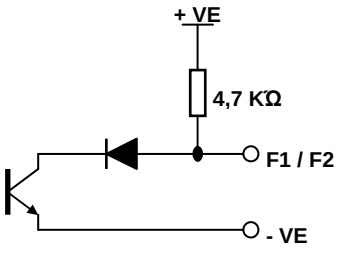
SERVICE OUTPUT (function by request)

SERV 1 Encoder speed output = 0

SERV 2 short circuit on outputs

3.2.2. ROTATION DIRECTION OF THE ENCODER AND SERVICE OUTPUTS





- DIR: input for the selection of the ENCODER rotation.

Conneting the DIR to -VE the encoder rotation is clockwise
Conneting the DIR to +VE the encoder rotation is anticlockwise

- **F1:** condiction of overload of channel 1 (CAM1 - CAM8)
- **F2:** condiction of overload of channel 2 (CAM9 - CAM16)

The F1 and F2 outputs are normally high (+24Vdc); in condiction of overload the go down (+VE) and disable the cam output (CAM1 - - - CAM2) till to a new switch on of the instrument.

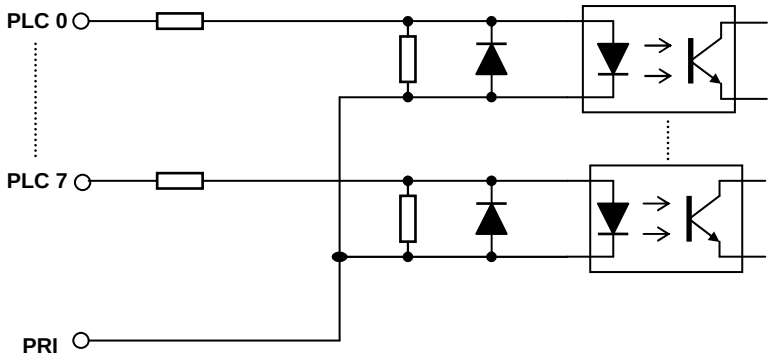
3.3. CONTROL FROM PLC

The device has 8 inputs from PLC from every channel programming for POSITIVE LOGIC or for NEGATIVE LOGIC, both independent.

With PLC is possible to carry out the operation of FORMAT change and to recall the 63 ALARM MESSAGES

3.3.1. CONFIGURATIONS AND CONNECTIONS OF INPUTS FROM PLC

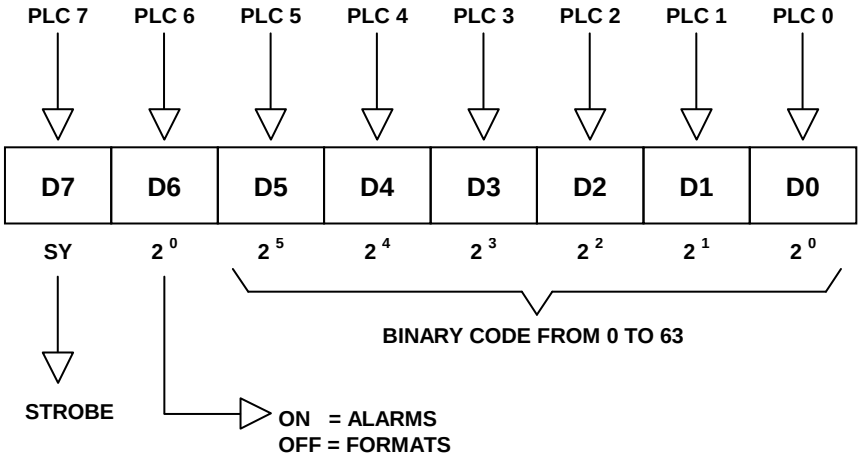
The inputs are configured in according to the following wiring diagram on principle:



The interface to PLC can be programmed for **POSITIVE** logic or **NEGATIVE** logic by simple connecting in the terminal board the terminal **PRI** (input programming) to the **negative common** or to the **positive common**.

POSITIVE logic	PRI = ground > > inputs
NEGATIVE logic	PRI = + Vdc > > inputs

The 8 inputs can be utilized according to the coding shown:



3.3.2. RECALL PROCEDURE OF MESSAGES

- Preset from PLC the alarm number to be visualized (from 1 to 63) in BINARY on the data D0..... D5.
- Preset in the same time the datum D6 to a 1 S.
- Send a pulse of at least 100 msec. to D7 (SY, synchronism or strobe) to store the configuration. On display will appear the message recalled and, if enabled, will be controlled the BEEP during 10 seconds. The led message will be superimposed to the date clock or to the previous alarm message. The alarm message can be reset by sending the same sequence with D0.... D5 all to 0 0 1 or with RESET keys from front side.

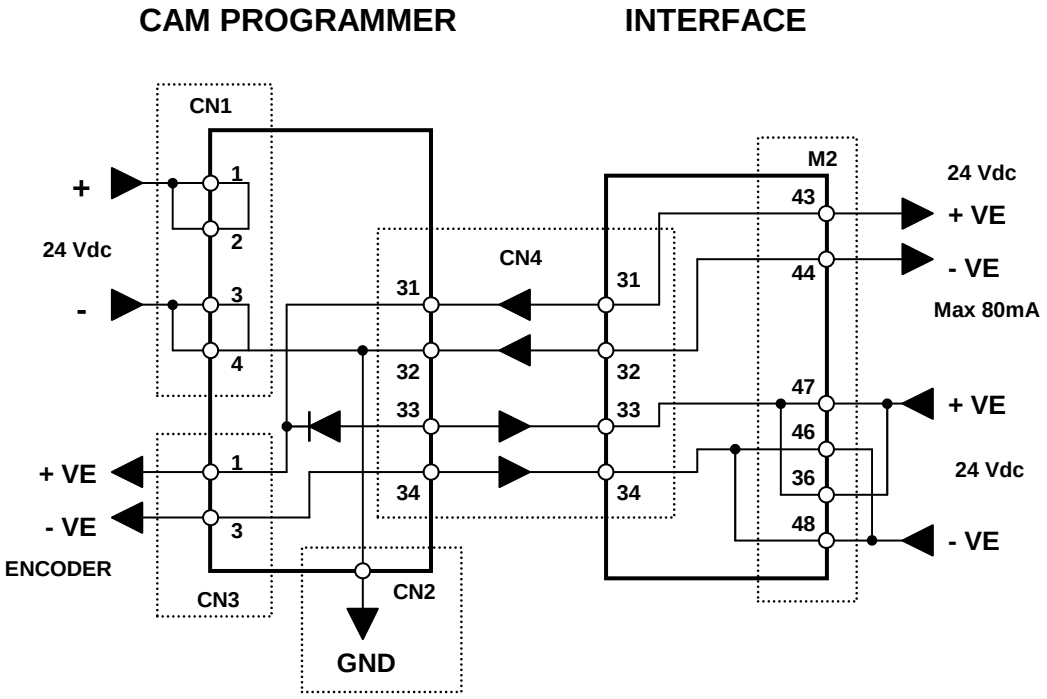
3.3.3. PROCEDURE FOR FORMAT CHANGE

To insert from PLC a new FORMAT, the following sequence shall be sent:

- Preset from PLC the number of the new format (from 0 to 16) in BINARY on the data D0 .... D5.
- Preset at the same time the datum on D6 at "0".
- Send a pulse of at 100 msec. to D7 (SY, synchronism or strobe) to store the configuration.
- It's necessary to wait 6 sec to load the new format and it's possible to execute this operation in working or not operating mode.

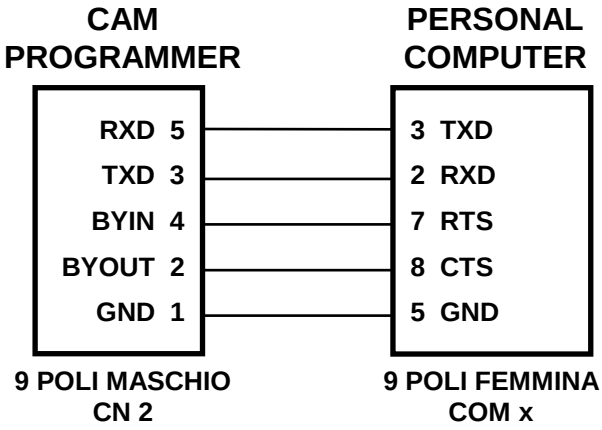
3.4. FEEDS AND THEIR DISTRIBUTION

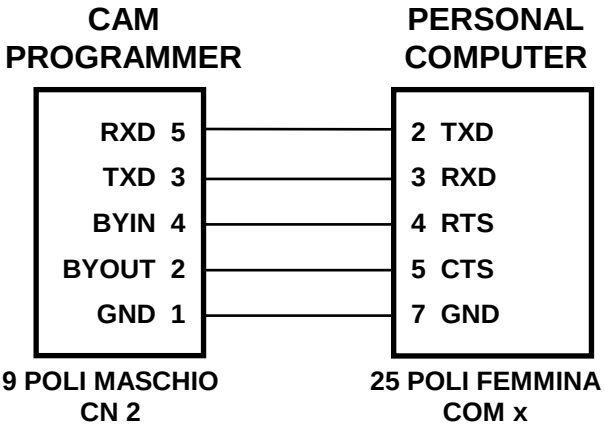
Here - below the general diagram of distribution and the connections of the various feeds in the device

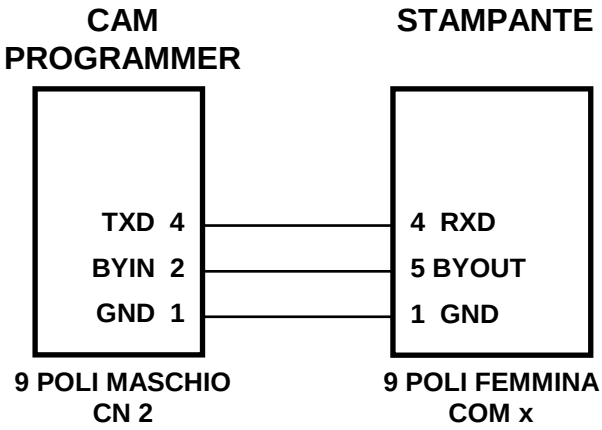


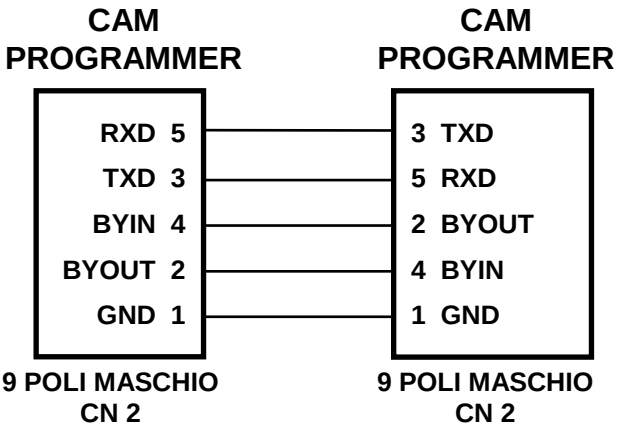
3.5. RS 232 SERIAL LINE

The CAM PROGRAMMER has a RS232 serial line for connection to a pen coup and to a printer, with the following schemes.



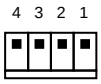
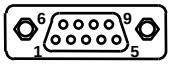
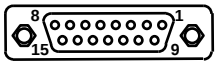
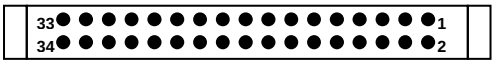






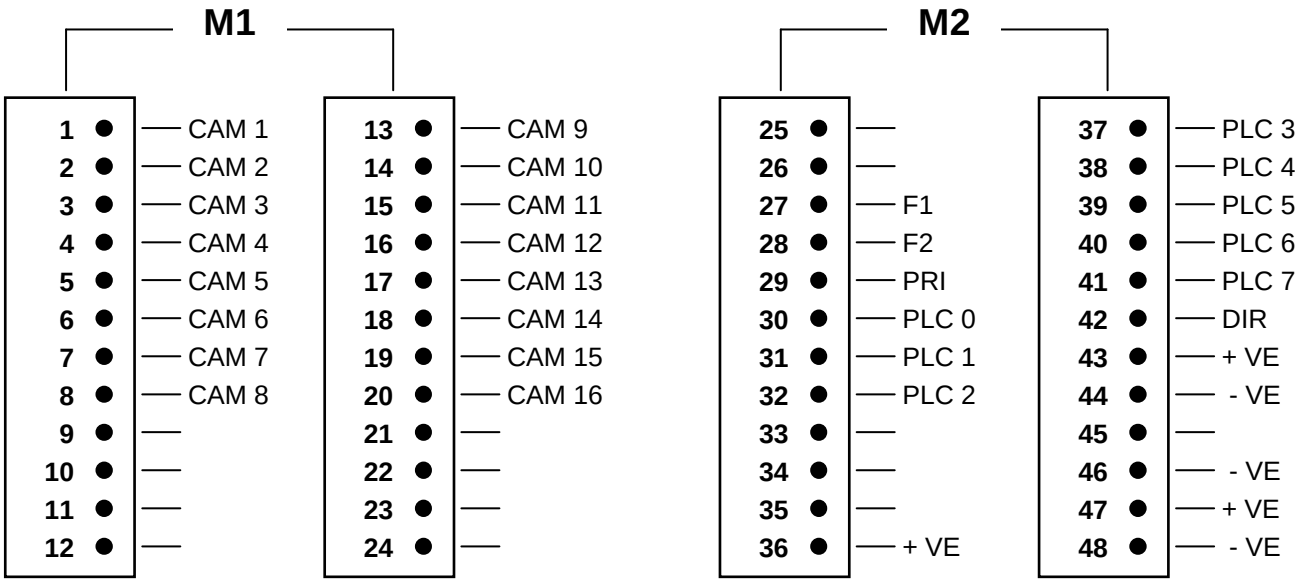
4. ACCESSORIES

4.1. CONNECTIONS

CN1		**1** +24Vdc **2** +24Vdc **3** -0Vdc **4** -0Vdc
CN2		**1** GND **2** BUSY OUT **3** TX **4** BUSY IN **5** RX **RS232**
CN3		**1** +VE / +24Vdc **2** - VE / - 0Vdc **3** - **4** ENC 9 / 2^9 **5** ENC 8 / 2^8 **6** ENC 5 / 2^5 **7** ENC 3 / 2^3 **8** ENC 1 / 2^1 **9** V / D **10** - **11** ENC 0 / 2^0 **12** ENC 7 / 2^7 **13** ENC 6 / 2^6 **14** ENC 4 / 2^4 **15** ENC 2 / 2^2
CN4		**1** CAM1 **2** CAM2 **3** CAM3 **4** CAM4 **5** CAM5 **6** CAM6 **7** CAM7 **8** CAM8 **9** CAM9 **10** CAM10 **11** CAM11 **12** CAM12 **13** CAM13 **14** CAM14 **15** CAM15 **16** CAM16 **17** **18** **19** FAULT 1 **20** FAULT 2 **21** PRI **22** PLC 0 **23** PLC 1 **24** PLC 2 **25** PLC 3 **26** PLC 4 **27** PLC 5 **28** PLC 6 **29** PLC 7 **30** DIR **31** + VE **32** - VE **33** + VE **34** - VE **35** **36**

4.2. BASE FOR CABLE INTERFACE TO THE SYSTEM

A special adapter to the system is interlocked to every two channels and turns the connections from flat cable to screw - type extricable terminal boards for cams and services, from flat cable to shielded cable for the encoders.



CN3

1	**+ VE / + 24 Vdc**	**9**	**U / $\overline{D}$**
2	**- VE / - 0 Vdc**	**10**	**- - - - - - - - - - - - -**
3	**- - - - - - - - - - - - -**	**11**	**ENC 0 / 2^0**
4	**ENC 9 / 2^9**	**12**	**ENC 7 / 2^7**
5	**ENC 8 / 2^8**	**13**	**ENC 6 / 2^6**
6	**ENC 5 / 2^5**	**14**	**ENC 4 / 2^4**
7	**ENC 3 / 2^3**	**15**	**ENC 2 / 2^2**
8	**ENC 1 / 2^1**		

The adapter shall be close to the instrument I .... 1,5 mt.)

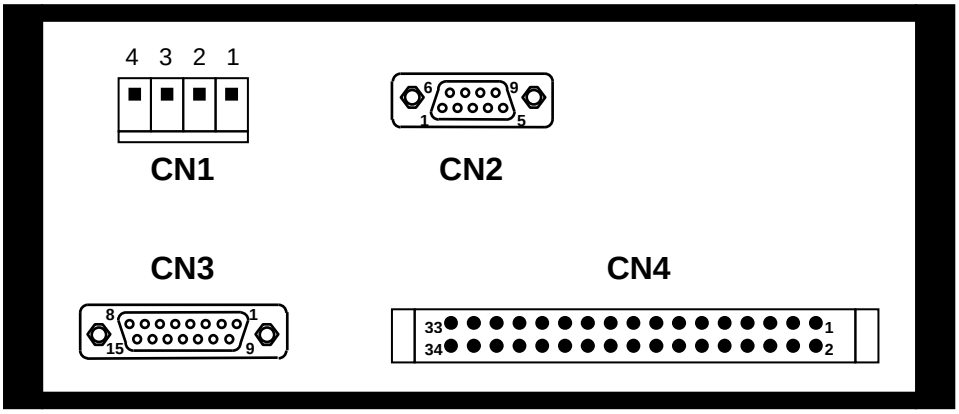
The cable for encoder shall be of the shielded type. The distance of the encoder from the instrument shell be always kept to the minimum absolutely necessary. In case the 20 mt. are exceeded, it is recommended to contact the manufacture to use suitable section.

The control parts can be brought to a distance of 50 mt and farther by using sections suitable to the loads and finishing always the connections with an independence to the ground.

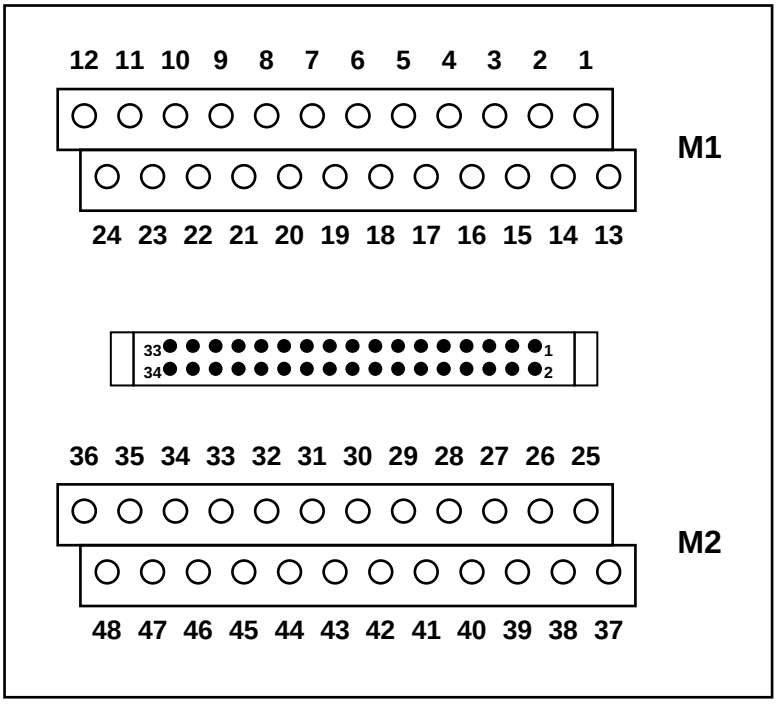
All the input / output signals are galvanically separated on the instruments; nevertheless it is recommended to keep the signal lines separated from the power ones in the system ducting.

5. MECCANICAL DROWINGS

5.1. CAM PROGRAMMER

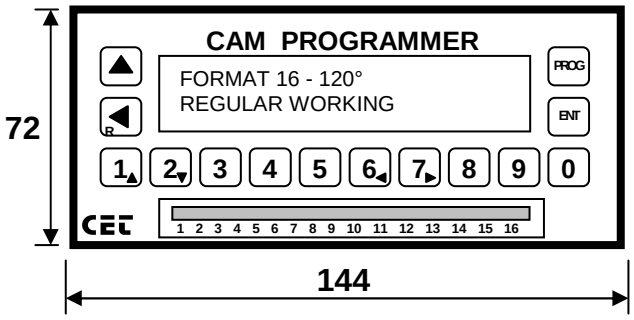


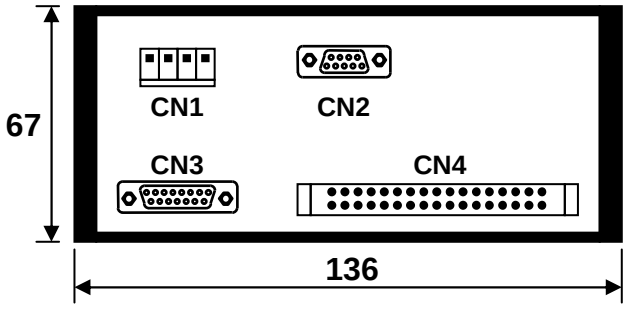
5.1.1. INTERFACE CARD



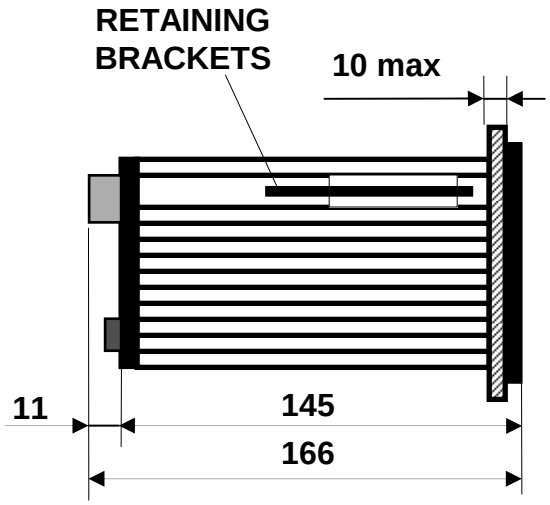
5.2. OVERALL DIMENSIONS

5.2.1. CAM PROGRAMMER

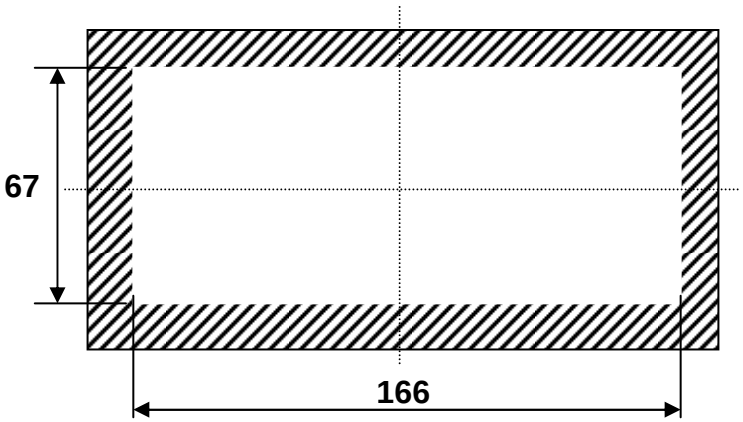




SIDE



DRILL



5.2.2. INTERFACE CARD