Gurd

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\ SHORT DESCRIPTION OF THE RMH READOUT SYSTEM FOR THE E704 MWPCS

\. Bravar, Y. Onel and A. Penzo

ABSTRACT

'his system encodes wire chamber hit information and is read sequ ntially. 'he readout of the data by the system is done internally; CAMAC is used only o comunicate with external devices.

'he RMH System

'his system was specified with emphasis on speed for operation with on-line)rocessors. It handles high input rates and provides very short read-out imes. The receiver and memory circuit are hybridized to give high packing lensity. The modularity of the system permits many different system :onfigurations. By replacement or addition of existing modules the ;ystem can be extended and the output format can be changed from binary :oding to data reduction by clustering or to pattern transfer.

A complete data acquisition chain is shown in Fig. 1.

The preamplifiers are mounted directly on the detectors. They are modular (32 channels), provide a differential gain of 7 and drive a 32 pair cable (80 m long, ~ 400 ns) which serves also as delay element.

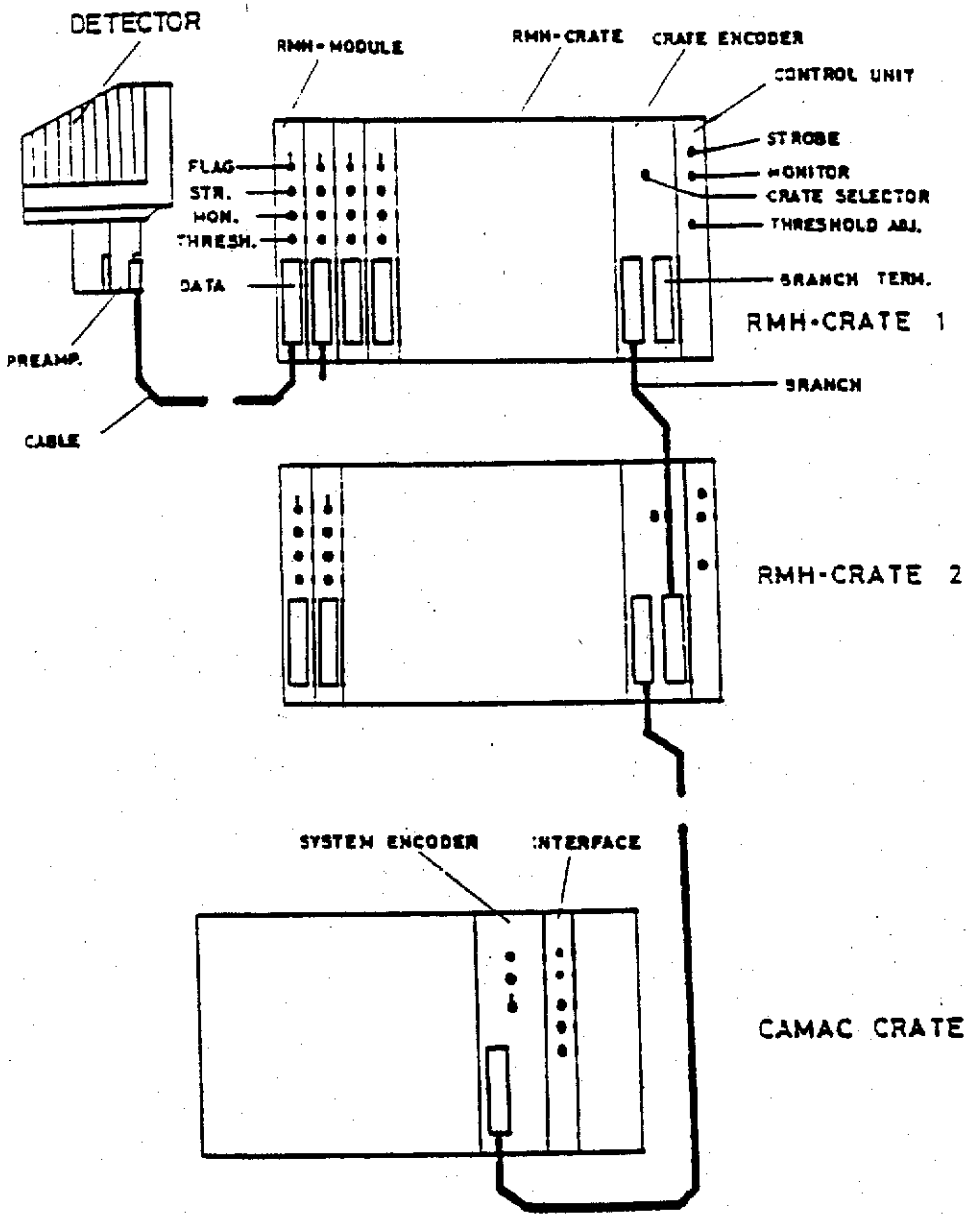

Fig. 1 BASIC SYSTEM CONFIGURATION

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The receiver memory hybrid modules (RMH) amplify the received detector signals (10 times) and strobe them into memory. An RMH module contains 32 channels with a hybrid circuit having an amplifier discriminator for each channel, a threshold voltage input (adjustable between 5 and 25 mV), a strobe input, a monitor output for real time monitoring and a flag switch. Up to 22 of these modules can be housed in a dedicated crate with CAMAC mechanics equipped with a fast (active) dataway. The flag switch may be used, for example, to indicate a different wire chamber. With the flag siwtch "ON" within a given module, the first data word (i.e. wire) with a hit registers the flag bit, unless there are no wires registering a hit in the module, and then it flags the first wire.

All stations in the crate can be strobed in parallel via the control unit (CU), which also contains the common threshold adjustement, a common monitor output, and a fast reset input to reset all RHMs in the crate. It also provides a bias voltage for the signal transmission on the active dataway.

The read-out of the stored information is performed by a crate encoder (CE) in each crate. Up to 16 CEs can be connected to the vertical dataway (branch), which is controlled by a system encoder (SE). This configuration allows up to 11,264 channels on a branch.

All crates need to have the same strobe pulse put into them. The timing between the data and the strobe is critical for operating the system. The minimum time

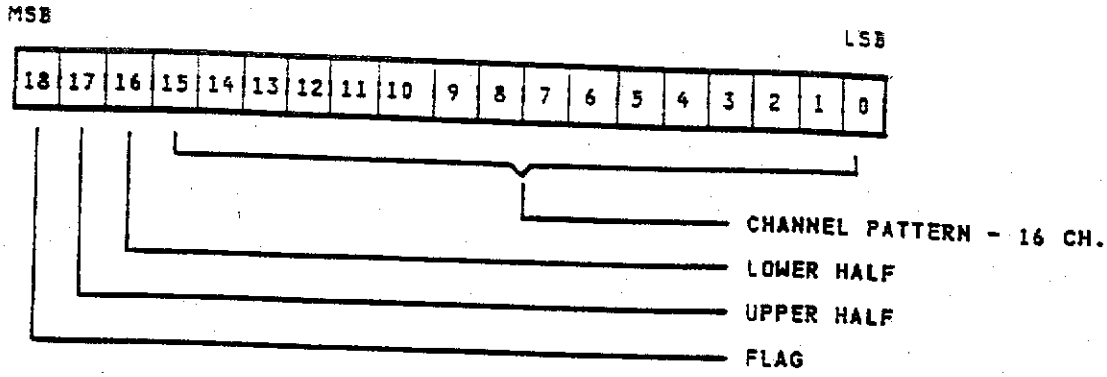


FIG. 2 DATAWAY PATTERN

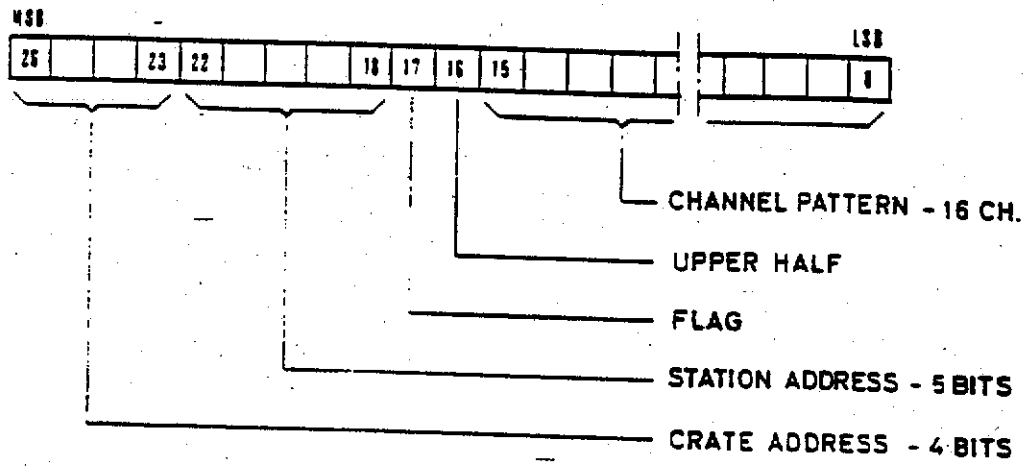


Fig. 1 BRANCH FORMAT

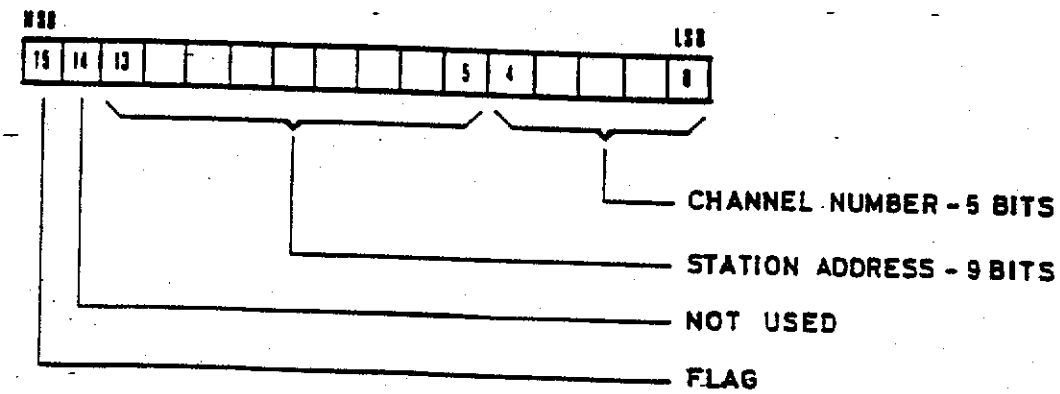


Fig. 2 BINARY FORMAT

1ns = 10^{-9} second

iat the leading edge (~ 4 ns) of the data pulse can arrive after the strobe gate is 20 ns. The minimum strobe width is ~ 40 ns.

he CE controls the read-out in the crate and encodes the module address, hile the hit channel patterns are transfered uncoded to the system encoder (SE). ata are logically divided into lower and upper halves. Only modules and halves ɔntaining data are addressed. In Fig. 2 is shown the data format. The first 5 its determine the wire number, the next 9 bits indicate the crate and ıodule number within that crate. The 15th bit is not used. The 16th bit ıdicates that a flag switch is either on or off.

daisy chain signal (EI) enables the CEs on the branch in the right order, ach transmitting its address which is set via the crate address switch. his signal propagates to the next CE when all module patterns within that rate has been transferred.

he SE starts the readout (Fig. 3) via the start read signal (SR), received from ıe external device, such as for instance the CAMAC interface processor (I/F). ;E receives branch data in strobed mode and codes each hit wire of the data ıattern into binary address, merges crate and module address from the CE ıto a contiguous station address and adds the flag bit to the first encoded it wire if present (16 bit word, Fig. 2). The function of SE itself is controlled ia an external device (for example the CAMAC interface). The end of read ignal (EOR) signal indicates the completion of an event.

he events may be re-read several times by receipt of a new SR signal. A

iscontinuity of SR signal during data transfer halts SE. In this case the ystem transfers incomplete events. The reset signal (RT) enables new data aking by resetting data in all RMH modules and logic in all CEs.

n Tab. 1 is shown the readout time for different configurations.

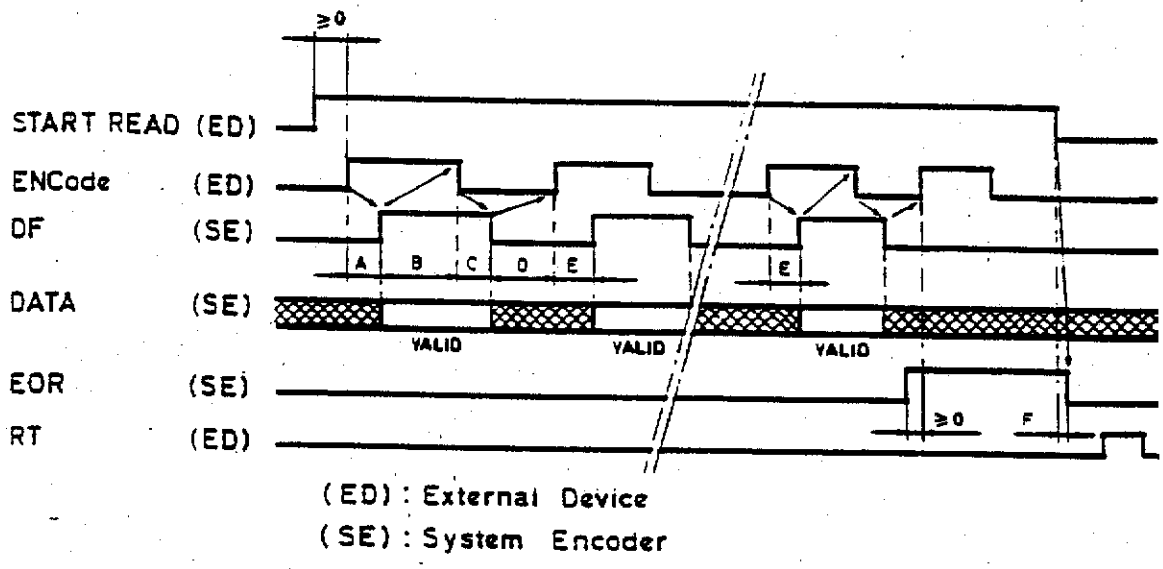
n the following will be given a more detailed description of each component.

TABLE 1

Data transfer times.
Read-out times: (a) No data in system: $T = T_0$. (b) Data in system: $T = T_1 + NT_N + T_E$; N is the number of hits (exception: burst buffer, where N is the number of modules containing data).

System		Maximum read-out and encoding times per data word (ns)						Limitations
		T_0	T_1	T_N		T_E		
Type	Read-out via	No data	First word	Next word		No more words		Response of external device ≤ 30 ns
				Same crate	Any other crate	Same crate	Any other crate	
Single branch	External device	160	210	100	200	80	100	≤ 16 crates
Multi-branch	External device	1050	1150	200	990	100	880	≤ 70 000 channels
Single crate	External device	80	160	120	–	80	–	≤ 608 channels
Burst buffer	Burst buffer	75	140–220[a]	80–160[a]	–	75	–	≤ 480 channels
Any system	CAMAC	Within start of read-out cycle		Every read cycle		Within last read cycle		–

[a] Data one half to both halves.



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urst uffer	Burst buffer	75	140–220[a]	80–160[a]	–	75	–	≤ 480 channels
ny ystem	CAMAC	Within start of read-out cycle		Every read cycle		Within last read cycle		–

Data one half to both halves.

TIMES (typical) :

A ~ 180 ns
B dependant of ED (+ int. 20 ns)
C ~ 30 ns
D dependant of ED (+ int. 20 ns)
E ~ 120 ns
F ~ 30 ns

Times with ~ 2 meters of cable to ED, add ~ 20 ns per additional meter of cable to times A, C and E.

PREAMPLIFIER, 32 CHANNELS, TYPE 4237

The instrument contains 32 preamplifier-drivers for signals from multiwire proportional chambers.

INPUTS

- 32 wire signal inputs (SOCAPEX connector)
- Power supply connector (-5.2 V and ground)

OUTPUTS

- 2 x 32 differential outputs for driving twisted pair cables.

SPECIFICATIONS

- Input impedance : 500 ohm
- Differential gain : (outputs loaded by 100 ohms) : 7 ± 1
- Differential output swing : (outputs loaded by 100 ohms) : max 300 mV.
- Crosstalk : > 30 db
- Output rise and fall-times : (20 to 80%) < 3 nsec

CONSUMPTION

-5.2 V , 350 mA

R.M.H. Module, Type 4236

The instrument contains 32 line Receiver - discriminator - Memory circuits for signals from preamplifiers (x 10) mounted on multiwire proportional chambers The individual channels are custom designed hybrid circuits. The unit is divided into two groups of 16 channels, which are read-out separately.

INPUTS

Frontpanel:

a) 32 wire signal inputs (push-pull via edge connector).

b) 1 Fast strobe (NIM LEMO connector).

c) Threshold control (plug).

d) Flag switch.

Rear Connector:

a) 1 Fast strobe (crate)

b) 1 Read

c) 1 Reset

d) Threshold control

OUTPUTS

Frontpanel:

a) Monitor (NIM, LEMO connector)

Rear Connector:

a) Data (16 x 2 pins), Flag (1 x 2 pins)

b) Mem. OR upper 16 channels (2 pins), Mem. OR lower 16 channels (2 pins), Mem. OR of 32 channels (2 pins).

c) Monitor (2 pins).

SPECIFICATIONS

a) Input threshold:

Adjustable between 5 and 25 mV (push-pull) for simulated fast wire pulses ($t_r = t_f \approx 10$ nsec).

b) Threshold for positive wire pulses:

> 100 times negative input threshold.

c) Crosstalk between channels:

< - 40 db

d) Min. fast strobe width:

≈ 10 nsec.

e) Propagation delay:

at 20 db overdrive, input-strobe gate ≈ 9 nsec, input-monitor output ≈ 12 nsec.

f) Time slewing:

3-20 db overdrive < 7,5 nsec.

3-40 db " < 9 nsec.

g) Max. rate:

At 3 db overdrive > 15 MHz.

h) Monitor output

NIM logic pulse (0-800 mV), 7 nsec width, can drive 50 Ω cable.

i) Temperature dependence (0-60°C)

Threshold: < 0,2%/°C

Propagation delay: < 1 nsec.

k) Consumption:

-5,2 V, 3A.

CONTROL UNIT TYPE 9294

for RMH System

The instrument controls a RMH crate in providing:

- the signals Strobe, Reset and threshold adjustment to the stations,
- -2 V bias for signal transmission on the active dataway.

It also delivers a general monitor output, which is made by OR-ing the monitor signals of all stations.

8 led's (one led for 2 or 3 stations) light if one or more data, LH, VH or flag are permanently in high state on the dataway (help for debug and control).

1. INPUTS

1.1 Front panel

- "STR" (STROBE), NIM input (LEMO connector)
- "RESET IN", NIM input (LEMO connector).

1.2 Rear connector

- RESET input (ECL, V_H active)
- MONITOR input, (ECL, V_H active)
- 8 inputs for "data failure".

2. OUTPUTS

2.1 Front panel

- "MON" (MONITOR), NIM output (LEMO connector)
- "-5.2 V" (LEMO connector)

2.2 Rear connector

- 9 STROBE outputs, push pull ECL
- RESET output ECL, V_H active
- D.C. ADJUST, for threshold.
- -2 V, for bias.

3. SPECIFICATIONS

3.1 STROBE

Nine drivers buffer the strobe signal coming from the front panel of the control unit towards 9 groups of modules via the dataway.

1 -	Stations	1, 2, 3	RMH module
2 -	"	4, 5, 6	" "
3 -	"	7, 8, 9	" "
4 -	"	10,11,12	" "
5 -	"	13,14,15	" "

6 - " 16,17,18 " "

7 - " 19,20 " "

8 - " 21,22 " "

9 - " 24 Crate encoder

3.2 RESET

The RESET inputs (NIM) of the front panel and rear connector (ECL) are OR'ed to give the RESET output (ECL), available on the rear connector, for all the modules.

3.3 MONITOR

All the monitor signals coming from the modules are OR'ed on the dataway and fed to the control unit to get a general monitor (NIM) from its front panel. Monitor signals are gated by the STROBE.

3.4 -5.2 V

This output is provided mainly for use as d.c. strobe to RMH modules or to the control unit.

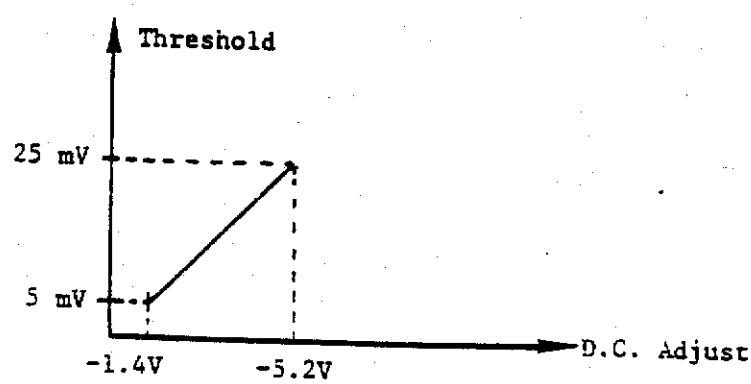
3.5 -2 V

This internal power supply permits the termination of ECL signal lines on the dataway and inside the modules with 100 Ω. Its output current is limited to 1 A.

3.6 THRESHOLD ADJUSTMENT

A potentiometer accessible from the front panel sets a D.C. voltage (D.C. adjust) which adjusts the thresholds of all modules in a crate.

- maximum threshold (+), D.C. adjust = -5.2 V
- minimum threshold (-), " " = -1.4 V



3.7 DATA FAILURE

A permanent high state of data output on the dataway (before the active OR) sets the led on, corresponding to the two or three stations OR'ed.

CRATE ENCODER, TYPES 7236 and 7236A

The Crate Encoder (CE) is designed to read-out data from-receiver-memory-hybrid modules (RMH), types 4236 and 4248, or from Plessey modules, types DR32-02. A functional block diagram is given in Fig. 1. It is housed in a special crate, RMH-crate, type 199. It occupies stations 23 and 24. Only RMH containing data are addressed and transfer their data pattern via the dataway to CE. CE completes these data patterns with the encoded station address and crate address to the format used on the branch - vertical dataway

The enabling of data transfer onto the branch is accomplished by the presence of the enable input signal (EI) on the branch input (BI) connector. If all RMHs (stations) containing data have transferred their pattern, the enable output signal (EO) arrives at the branch output (BO) connector, disables the present active CE and enables the next CE in the branch (EO is connected to EI of the next CE via the branch cable).

The data pattern - containing hit wires, upper half and flag bit (pulses) - is accompanied by a strobe signal; station address and crate address are stable before the data pulses are sent. Data transfer on the branch is controlled by the system encoder module (SE), type 158. A front panel switch (ON-line) enables the data transfer from the CE onto the branch (7236A only).

1. INPUT

Branch Input connector: p.c.b. edge connector, 2x35 contacts, 1/10" pitch, ECL signals (single ended driven, other wire of pair statically -1.4 V: EIF and EI are driven push-pull).

2. OUTPUT

Branch Output connector: p.c.b. edge connector, 2x35 contacts, 1/10" pitch, ECL signals (single ended driven, other wire of pair statically at -1.4 V; EIF and EO are driven push-pull).

3. CONTROL

Front panel

3.1 Crate Address switch: can be set to desired crate address (1 to 16); rotary hexadecimal type.

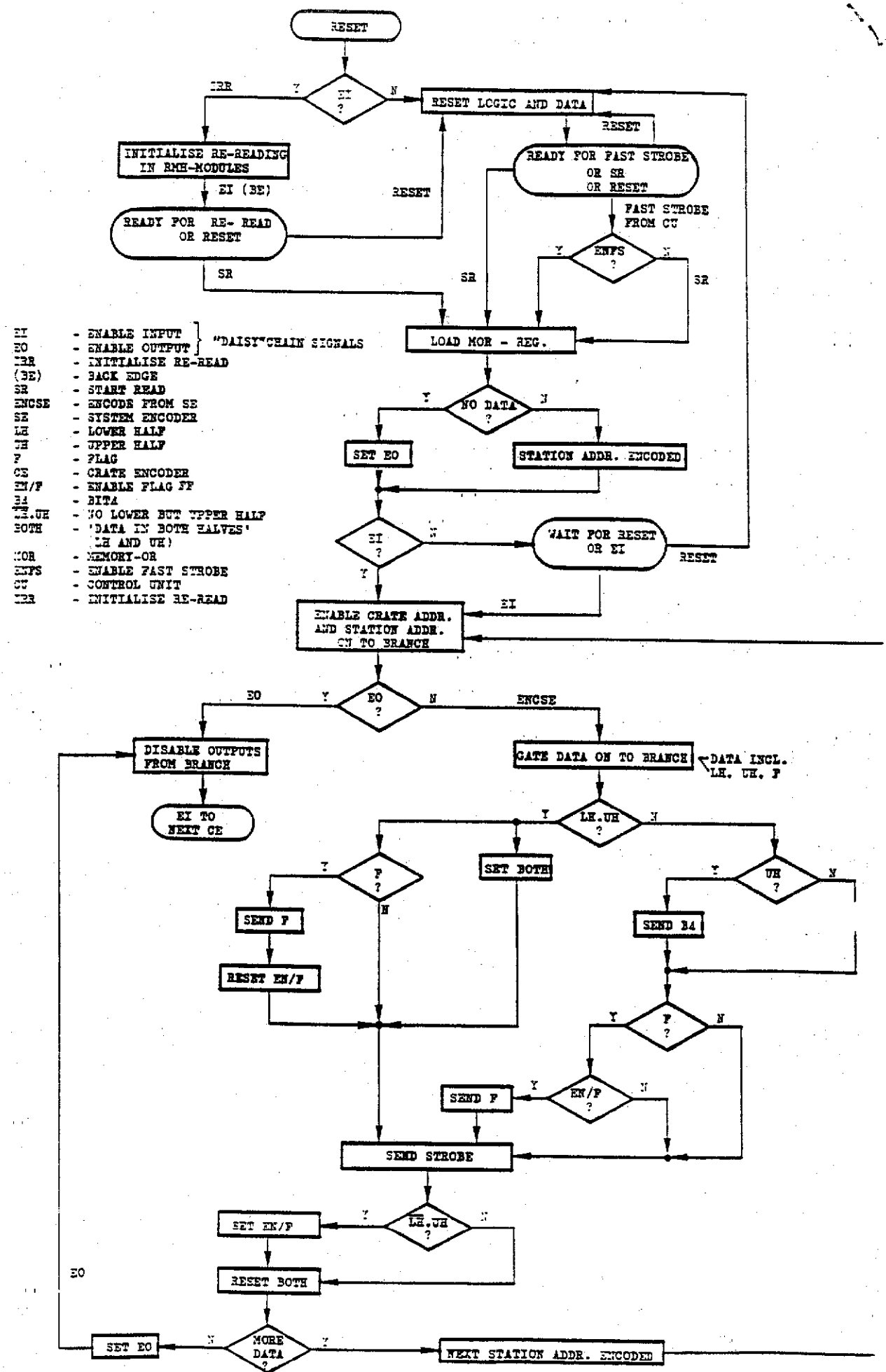
3.2 On-line switch: enables or disables the read-out from CE and its crate: toggle type switch (7236A only).

3.3 On-line indicator: indicates the status of the CE: red LED (7236A only).

4. DATAWAY CONNECTIONS (RMH-Crate): p.c.b. edge connectors, 2x43 contacts, 1/10" pitch. All signals ECL compatible.

5. MECHANICS: CAMAC mechanics, 2 units wide.

6. POWER SUPPLY: -5,2 V/3,5 Amps.



EI - ENABLE INPUT } "DAISY"CHAIN SIGNALS
EO - ENABLE OUTPUT }
IRR - INITIALISE RE-READ
(BE) - BACK EDGE
SR - START READ
ENCSE - ENCODE FROM SE
SE - SYSTEM ENCODER
LH - LOWER HALF
UH - UPPER HALF
F - FLAG
CE - CRATE ENCODER
EN/F - ENABLE FLAG FF
B4 - BIT4
LH.UH - NO LOWER BUT UPPER HALF
BOTH - 'DATA IN BOTH HALVES' (LH AND UH)
MOR - MEMORY-OR
ENFS - ENABLE FAST STROBE
CU - CONTROL UNIT
IRR - INITIALISE RE-READ

FLOW CHART

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BRANCH RECEIVER, TYPES 178 AND 178A

The Branch Receiver (BR) is designed to extend the addressing capability of the basic RMH-system . Several of these BRs (up to 18) can be connected in a "daisy chain" configuration to the internal input bus (IIB) of a system encoder module (SE), type 158, to provide data from several RMH-branches (vertical dataway). See Fig.1 for a multi-branch configuration. Each BR provides appropriate termination of an RMH-branch, transmits branch data (format see Fig.2) via IIB to SE, and buffers all control signals. A front panel switch provides for "first", enable and disable (type 178 only).

The revised version, type 178A, uses a front panel NIM input (OP, for operational) which provides for enabling or disabling of each BR and the connected RMH-branch. This permits selective reading of branches within a system.

The RMH-branches connected to BRs are read-out similar to the single branch system (basic RMH-system), commencing with the leftmost enabled BR*. The enable input signal (EI) propagates through all BRs enabling only one BR (and the corresponding branch) at a time.

1. INPUT

Branch Input connector (BI): p.c.b. edge connector, 2x35 contacts, 1/10" pitch: ECL signals (single ended driven, other wire of pair is statically on -1,4 V; EIF and EO are driven push-pull).

2. OUTPUT

2.2 Internal Input Bus (IIB):

2.2.1 Connections to next BR (or SE): 2 x flat cables (40 wires each) with socket connectors: ECL signals (single ended driven, other wire of pair is statically on -1,4 V: EIF and EO are driven push-pull).

2.2.2 Connections to preceding BR (or branch receiver terminator (BRT), 2x40 contacts (2x2x20 headers): ECL signals (single ended driven, other wire of pair is statically on -1,4 V: EIF and EO are driven push-pull).

3. CONTROL

3.1 Front Panel:

3.1.1 BUSY Indicator: indicates status, "ON" when BUSY.

3.1.2 Mode Switch (type 178 only**): toggle switch, 3 positions:

- First : This BR will be read first, all preceding BRs (to the left of it) are ignored.
- Normal : BR is enabled.
- Disabled: BR will not be read.

3.2 OP Input (type 178A***): NIM signal, true for operational (enabled), must be held during whole data transfer ("static" signal), Z_i = 500.

3.3 Rear Panel:

3.3.1 Threshold Adjustments: Access to potentiometers for threshold adjustments for receiver circuits of strobe signal and data signals. These potentiometers are preset and should not be touched under normal operating conditions. Exceptionally their setting may have to be altered during the setting-up of a system.

4. DATAWAY CONNECTOR: (rear p.c.b. connector, 2x43 contacts, $^1/_{10}$" pitch):

- Only power supply and ground connections.

Unit may be inserted either in RMH-crate**** or in standard CAMAC crate.

5. MECHANICS: CAMAC mechanics, 1 unit wide.

6. POWER SUPPLY: -5.2 V/1.0 Amps or -6 V/1.0 Amps.

7. REMARKS:

Can only be used in conjunction with an SE. The IIB must be terminated inside the leftmost BR with 2 BRTs BRs are mounted together with SE to form a compact multi-module plug-in unit.

By use of BRs in an RMH-system the BI of the SE shall not be used to input branch data; it can be used to monitor IIB signals.

*) Note: When using type 178 the read-out starts at the BR with its mode switch in position "first" (see also 3.1.2).

**) Note: At least one BR in a multi-branch configuration must have its mode switch in position "first", in general the leftmost BR, otherwise a "hang-up" condition will occur.

***) Note: All operational BRs (and branches) will be read according to their physical position in the multi-module plug-in assembly, commencing with the leftmost (enabled) BR.

****) Note: If interface (IF) connected to system unit must be inserted in CAMAC crate.

SYSTEM ENCODER TYPE 158

The System Encoder (SE) is designed to control the read-out of a chain of crate encoder modules[1] (CE), types 7236 or 7236A, connected to the vertical dataway (branch). It receives data from the branch via the branch input connector* or the internal input bus in strobed mode (format, see Fig. 1), encodes each hit wire of the data pattern into a binary address, merges crate and station address from CE into a contiguous station address and adds the flag bit (if present) to the first encoded hit wire (format, see Fig. 2). The function of SE itself is controlled via an external device (ED), for ex.: the CAMAC interface[2] (IF), type 159, or processor via a fan-out[3] (FO), type 180, connected to the internal output bus or to the data output connector**. See block diagram, Fig. 3. The conversation with the ED uses double handshake mode (see Fig. 4). A NIM output provides a signal (BUSY) indicating the complementary status. A control signal (ENFS) enables all CEs within a system to commence the preparation for data transfers from the first RMH module containing data within each crate, either via the start read signal (SR) from the ED or via the back edge of the fast strobe signal from the control unit module[4] (CU), type 9294, depending on the position of the start switch - external device or crate intern***.

The enable input signal (EI) enables the CEs to gate their data pattern, station address and crate address onto the branch. A rear input connector (NIM level) provides for an external reset to the SE, this also resets data in RMHs and CEs.

Examples for the extension of the basic system to a multi-branch and/or multi-output systems can be found in refs. 1 and 5. These options can be also implemented at a later stage. An assembled system (with options) represents a compact multi-module plug-in unit**** which - in general - will be inserted into a standard CAMAC crate.

*) Note: The branch input connector shall not be used in a multi-branch configuration which uses the internal input bus.
**) Note: The data output connector shall not be used in a multi-output configuration which uses the internal output bus.
***) Note: If the position "crate intern" of the start switch is used a hang-up condition may occur if the crates are not strobed.
****) Note: Individual units cannot be extracted from this plug-in without extraction of the whole plug-in from the crate.

1. INPUT

1.1 Branch Input connector (BI): p.c.b. edge connector, 2x36 contacts, 1/10" pitch: ECL signals (single ended driven, other wire of pair statically at -1,4 V):
Connections: see Fig. 5.

1.2 Internal Input Bus connector (IIB)*: 2x40 contacts (2x2x20 headers): ECL signals (single ended driven, other wire of pair statically at -1,4 V; EIF and EO are driven push-pull).
Connections: see Fig. 6.

1.3 Branch termination: All branch signals are terminated with appropriate resistors inside module.

2. OUTPUT

2.1 Data Output connector (DO): p.c.b. edge connector, 2x35 contacts. 1/10" pitch: ECL signals (complementary). Connections: see Fig. 7.

2.2 Internal Output Bus connector (IOB)**: receptacle (female) for headers. 2x20 contacts: ECL signals (single ended driven. other wire of pair statically at ground). Connections: see Fig. 8.

3. CONTROL

3.1 Front panel:

3.1.1 BUSY output: complementary NIM signal, false (0 Volts) if unit is busy: if used must be terminated with 50 Ω.

3.1.2 BUSY indicator: indicates status, "ON" when BUSY.

3.1.3 Start switch: toggle switch, 2 positions:

- crate intern (CRATE INT.)
- external device (EXT. DEVICE)

Enables the preparation for the first data transfer to the external device (ED) via either the start read signal from ED or the trailing edge of the common strobe from the CU within each crate.

3.2 Rear panel:

3.2.1 Reset input: NIM signal, internally terminated (50 Ω), min. width = 10 nsec: resets SE logic, all CEs and RMHs in system.

4. DATAWAY CONNECTIONS: (rear p.c.b. connectors, 2x43 pins, 1/10" pitch).

No connections to dataway except for power supply and ground connections (see Fig. 9).

REMARK:

Unit may be inserted either in RMH-crate*** or in a standard CAMAC crate.

5. MECHANICS: CAMAC mechanics, 2 units wide.

6. POWER SUPPLY: -5,2 V/4,5 Amps or -6 V/4,5 Amps.

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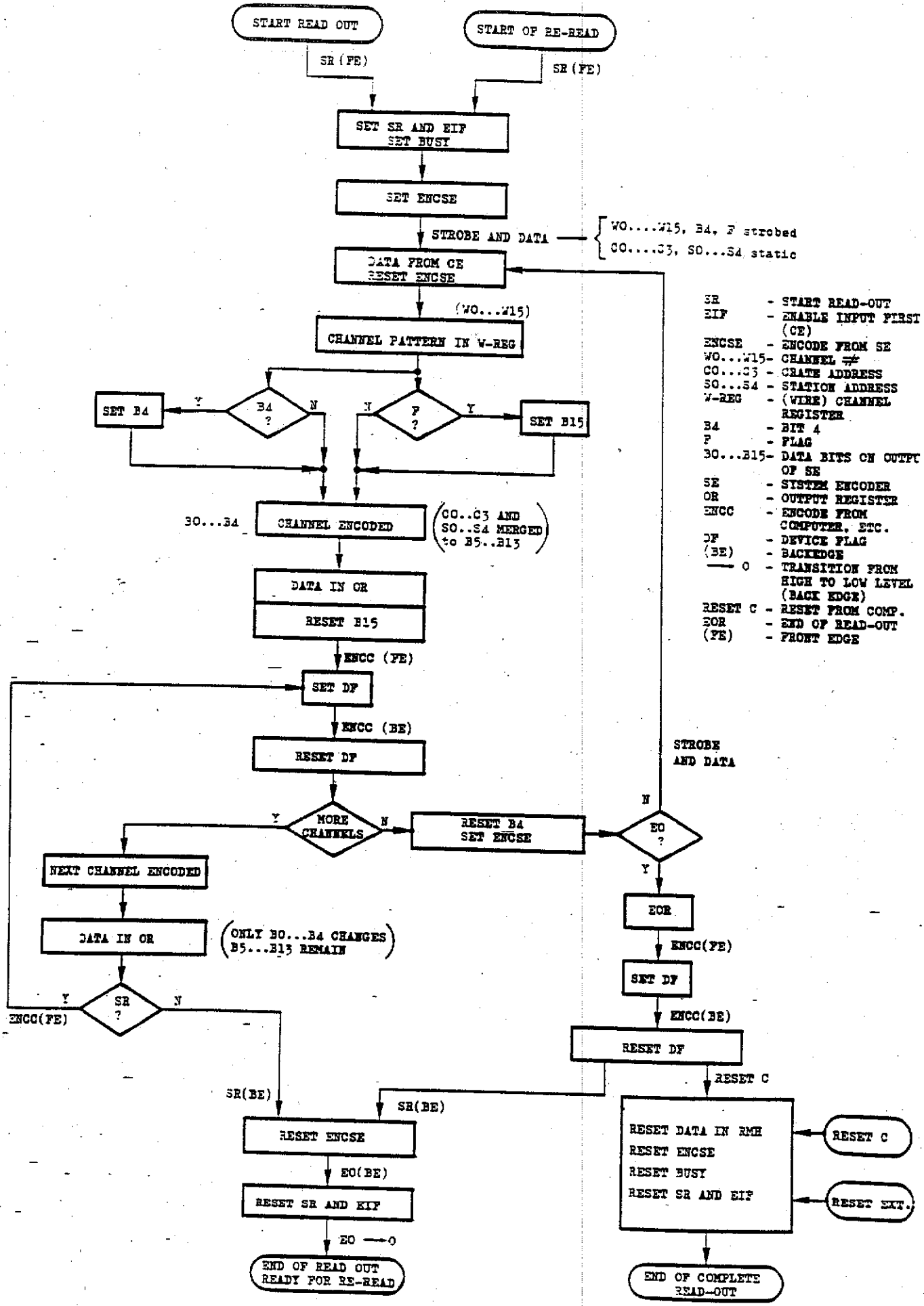
*) Option: only used in multibranch configuration.
**) only used if ED is connected to IOB.
***) Remark: If interface (IF) connected to IOB, unit must be inserted in CAMAC crate.


START READ OUT
START OF RE-READ
SR (FE)
SR (FE)
SET SR AND EIF
SET BUSY
SET ENCSE
STROBE AND DATA
WO....W15, B4, F strobed
CO....C3, SO...S4 static
DATA FROM CE
RESET ENCSE
(WO...W15)
CHANNEL PATTERN IN W-REG
SET B4
Y
B4 ?
N
N
F ?
Y
SET B15
B0...B4
CHANNEL ENCODED
(CO..C3 AND SO..S4 MERGED to B5..B13
DATA IN OR
RESET B15
ENCC (FE)
SET DF
ENCC (BE)
RESET DF
Y
MORE CHANNELS
N
RESET B4
SET ENCSE
N
EO ?
Y
NEXT CHANNEL ENCODED
DATA IN OR
(ONLY B0...B4 CHANGES B5...B13 REMAIN
Y
SR ?
N
ENCC(FE)
SR(BE)
RESET ENCSE
EO(BE)
RESET SR AND EIF
EO —0
END OF READ OUT READY FOR RE-READ
STROBE AND DATA
EOR
ENCC(FE)
SET DF
ENCC(BE)
RESET DF
RESET C
SR(BE)
RESET DATA IN RMH
RESET ENCSE
RESET BUSY
RESET SR AND EIF
RESET C
RESET EXT.
END OF COMPLETE READ-OUT
SR - START READ-OUT
EIF - ENABLE INPUT FIRST (CE)
ENCSE - ENCODE FROM SE
WO...W15- CHANNEL #
CO...C3 - CRATE ADDRESS
SO...S4 - STATION ADDRESS
W-REG - (WIRE) CHANNEL REGISTER
B4 - BIT 4
F - FLAG
B0...B15- DATA BITS ON OUTPT OF SE
SE - SYSTEM ENCODER
OR - OUTPUT REGISTER
ENCC - ENCODE FROM COMPUTER, ETC.
DF - DEVICE FLAG
(BE) - BACKEDGE
—— 0 - TRANSITION FROM HIGH TO LOW LEVEL (BACK EDGE)
RESET C - RESET FROM COMP.
EOR - END OF READ-OUT
(FE) - FRONT EDGE

FLOW CHART

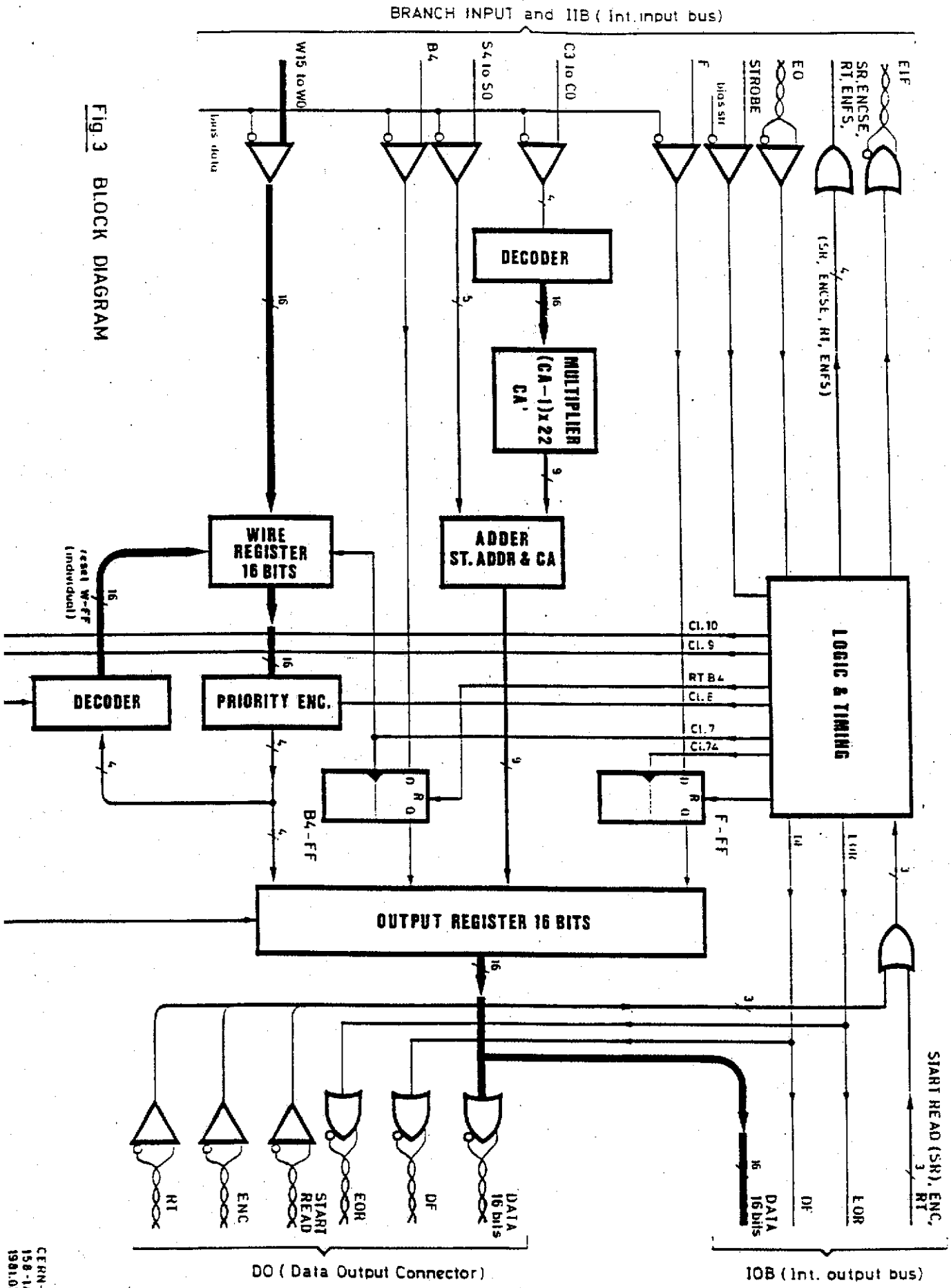


Fig. 3 BLOCK DIAGRAM

CERN-EP
158-1A3
1981.02.02 Borcard

FAN-OUT, TYPES 180 and 180A

TECHNICAL SPECIFICATIONS

The Fan-Out (FO) is designed to permit the RMH-system[1,2] to be read-out via additional external devices (ED), for ex.: processors, direct computer interfaces, buffers, etc. See block diagram on Fig. 1. Several FOs - one for each ED - can be connected to the internal output bus (IOB) of the system encoder module[3] (SE), type 158. Fig. 2 shows a multi-output configuration, Fig. 3 the data format.

The type 180 permits reading via only one ED at a time (serial mode).

The revised version, type 180A, permits two operating modes: single (serial) mode - where each ED exclusively requests data from SE, or parallel mode - where all EDs receive data in parallel, the "slowest" ED then determines the data transfer speed. These modes can be selected by external NIM signals: OP (operational = enabled) and PAR* (parallel): see Table 1 for combinations. An error condition will occur, if in single mode any other ED requests also data from the SE; indication via ERR lamp (error lamp on front panel), a NIM signal (ERR) is available via the rear panel.

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*) Note: In parallel mode all enabled FOs must request data, if any of them does not act accordingly a "hang-up" condition occurs: a system time-out should be foreseen.

1. INPUT

1.1 Internal Output Bus Connections (IOB):

1.1.1 Connections to SE: long headers, 40 contacts (2x20): ECL signals (single ended driven, other wire of pair statically at ground).

Connections: see Fig. 4.

1.1.2 Connections to following FO (or interface) (IF), type 159: flat cable (40 wires) with socket connector: ECL signals (single ended driven, other wire of pair statically at ground).

Connections: see Fig. 4.

1.1.3 Connections to preceding FO: short headers, 40 contacts (2x20): ECL signals (single ended driven, other wire statically at ground).

2. OUTPUT

Data Output (DO) connector, p.c.b. edge connector, 2x35 contacts, 1/10" pitch: ECL signals (complementary).
Connections: see Fig. 5.

3. CONTROL

3.1 Front Panel:

3.1.1. OP Input: NIM signal, true (-0,8 V) for operational (enabled), must be held during data transfers ("static" signal). Z_i = 50 Ω.

3.1.2 PAR input: NIM signal, true (-0,8 V) for parallel mode, must be held during data transfers ("static" signal). Z_i = 50 Ω.

3.1.3 BUSY indicator: indicates status, yellow, "ON" when BUSY.

3.1.4 PAR indicator: green, "ON" when PAR.

3.1.5 ERR indicator: red, "ON" when ERR.

3.2 Rear Panel:

3.2.1 ERR output: NIM signal, true (-0,8 V) if error: if used must be terminated with 50 Ω.

4. DATAWAY CONNECTIONS (rear p.c.b. connector, 2x43 contacts, 1/10" pitch).

Only power supply and ground connections, see Fig.6.

Unit may be inserted either in RMH-crate or in standard CAMAC crate*.

5. MECHANICS: CAMAC mechanics, 1 unit wide.

6. POWER SUPPLY: -5.2 V/1.2 Amps or -6 V/1.2 Amps.

7. REMARKS:

Unit can only be used in conjunction with SE. All FOs are mounted together with the SE and, in general with an IF and form a compact multi-module plug-in unit.

The DO connector of the SE shall not be used for data transfer from the SE: DO is not protected against erroneous use (as on

INTERFACE, TYPE 159

TECHNICAL SPECIFICATIONS

The Interface (IF) controls the data transfer from a RMH read-out system[1] via a system encoder module[2] (SE), type 158, into CAMAC[3] In the basic system configuration[4] (Fig. 1) SE and IF are mounted together to form a triple width CAMAC plug-in module.

Read-out of data from the system can be started either via a start read-out command from CAMAC (see 3.1) or via an external signal (START, NIM level) accessible from the front panel. The NIM output signal (BUSY) indicates the status of the module and can be used for event blocking, etc. Binary coded data (Fig. 2) is received from SE via the internal output bus (IOB).

The transfer of data from the IF to CAMAC can be accomplished by means of single transfers as well as by use of one of several possible blocktransfer modes (see 4). After the last word has been transferred to CAMAC a NIM signal indicating the end of the data block (BE), on the front panel, will be active. This signal can be used to terminate the blocktransfer, or to interrupt the computer, etc. At the end of a normal read-out cycle a reset command (see 3.1) will be sent in order to reset the IF, the SE, and the data in the RMH-modules (RMH), types 4236[5] or 4248[6]. The reset command sets the BE and BUSY signal inactive, thus enabling the system to accept a new event.

Via the IF events can be re-read several times. This can be accomplished by sending a new start read-out command from CAMAC instead of the reset command as described above. It should be noted that the reset command must be sent before the system may accept a new event.

The IF can only be used in connection with a SE module.

1. INPUT

Internal Output Bus connection (IOB): 1x40 (2x20) headers (wrap pins): ECL signals (single ended driven, other end of pair statically on ground).

Connections: See Fig.3.

2. CONTROL (Front panel)

2.1 START input (start read-out):
NIM signal; min. 50 nsec. internally terminated with 50 Ω.

2.2 BUSY ouput:
NIM signal, true (- 0,8 V) if unit is busy; if used must be terminated with 50 Ω.

2.3 Block End output (BE):
NIM signal, true (- 0,8 V) if no more data words in system; if used must be terminated with 50 Ω.

2.4 Select indicator (SEL):
red, "ON" when addressed by CAMAC.

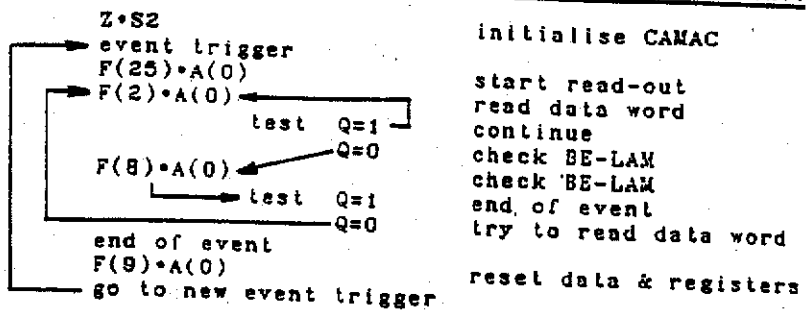
2.5 BUSY indicator:
yellow, "ON" when busy.

3.1 List of commands:

FUNCTION	RESPONSE (Q)	DESCRIPTION
F(2)•A(0)	yes, if (BUSY•$\overline{BE}$)	read data
F(8)•A(0)	yes, if (BUSY•BE)	test block end (LAM)
F(9)•A(0)	yes	reset data & registers, BUSY & BE
F(25)•A(0)	yes	start read-out or start re-reading
Z•S2	no	initialise, ident. to F(9)•A(0)
C•S2	no	clear data register

$\overline{BUSY}$ = START + F(25)•A(0).....set BUSY
$\overline{BUSY}$ = Z•S2 + F(9)•A(0).....reset BUSY
BE = BUSY • EOR *.....set BE
$\overline{BE}$ = F(9)•A(0) + F(25)•A(0).....reset BE

3.2 Sample program (shows program control operation):



4. BLOCK TRANSFER MODES

4.1 UQC (repeat) mode: see refs. 7, 11, 12.

The command F(2)•A(0) must be used to read-out data. The end of a data block is indicated by the BE signal.

Nord-10 computer systems: The VIB input could be used to termi-

4.2 UQL (pause) mode: see ref. 11, 12.

The command F(2).A(0) must be used to read-out data. The end of a data block is indicated by the positive response (Q=1) to the F(8).A(0) command which tests the block end LAM (block end look-at-me). This mode is implemented by hardware in the Borer branch driver. Note that there is no LAM signal available at the dataway connector (see 5).

This mode is not applicable to the Nord-10 computer systems and CAVIAR systems used at CERN.

4.3 UCS (stop) mode: see refs. 7, 11, 12.

This mode uses also the command F(2)•A(0) to read-out data. Contrary to the above mentioned block transfer modes (UQC, UQL) this mode tests the response (Q) and terminates the data block by absence of a positive response (Q=0).

Note that the UCS mode is not generally applicable** and that it should only be used for small RMH read-out systems up to 4.000 channels. Nevertheless it is a very convenient method for testing and it is supported by many CAMAC-computer interfaces (f.ex.: CAVIAR systems).

5. DATAWAY CONNECTIONS

See ref. 3 for connections (Table II, p. 15: contact allocation at a normal station).

6. MECHANICS

Single width CAMAC module: in basic configuration with the SE combined to a triple width module. For use in other system configurations see refs. 1 and 4.

7. POWER SUPPLY

+ 6 V / ... A

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