



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS INS 167

**Pump Unit
standard function
- P.U. -**

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Contents

1. Scope	3
2. Reference documents.....	3
3. General Description of functions.....	4
3.1 List of main functions	4
3.2 Start / stop sequence description for a Centrifugal pump unit (PU_CENT).....	4
3.3 Start/stop sequence description for a Centrifugal pump unit with SDV only (PU_CENT_1SDV)	5
3.4 Start/stop sequence description for a Centrifugal pump unit with XV only (PU_CENT_1XV)	5
3.5 Start/stop sequence description for a Centrifugal pump unit with XV suction and discharge valves (PU_CENT_2XV).....	5
3.6 Start/stop sequence description for Reciprocating pump unit (PU_RECIP)	5
4. Interface description	6
4.1 General description.....	6
4.2 Status description (status).....	8
5. Detailed description of functions	8
5.1 Modes and commands.....	8
5.2 Sequential function chart generalities.....	9
5.3 Sequential chart of centrifugal pump unit (PU_CENT).....	10
5.4 Sequential chart of Centrifugal pump unit with SDV only (PU_CENT_1SDV).....	13
5.5 Sequential chart of Centrifugal pump unit with only XV (PU_CENT_1XV).....	17
5.6 Sequential chart of centrifugal pump unit with XV Suction and Discharge valves (PU_CENT_2XV)	21
5.7 Sequential chart of Reciprocating pump unit (PU_RECIP)	25
6. Tuning parameters and variables	28
6.1 Centrifugal pump unit.....	28
6.2 Reciprocating pump unit	28
7. Representation and animation description (HMI).....	29
7.1 Events and values to be recorded	29
7.2 Process control display (operating level display)	29
8. Appendix: handling of status in case of centrifugal pump unit (PU_CENT)....	31



1. Scope

The purpose of this document is to define the Standard Function of a Pump Unit (P.U.), allowing the control of a pumping run, including motor, suction and discharge valves when available.

In order to assist in understanding, the document should be read in conjunction with **GS INS 150**, Design Methods for System Configuration Standard Functions.

This standard may be interlocked with :

- lower level Standard Functions :
 - MOT
 - XV
 - SDV
- higher level Standard Function: Duty / Back-up / Stand-by (D/B/S)

It includes five options :

- Centrifugal pump unit with SDV and XV discharge valve (PU_CENT)
- Centrifugal pump unit with SDV only (PU_CENT_1SDV)
- Centrifugal pump unit with XV only (PU_CENT_1XV)
- Centrifugal pump unit with XV suction and discharge valves (PU_CENT_2XV)
- Reciprocating pump unit (PU_RECIP)

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

**Codes**

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS INS 150	Design Method for System Configuration Standard Functions

3. General Description of functions

3.1 List of main functions

- Pump unit start/stop sequence
- Interface with D /B /S Standard Function :
status and fault, start/stop
- Interface with SDV, MOTOR, XV Standard Functions :
status and fault, start/stop, open/close, standalone/cascade mode
- Use of Operator commands : Manual/Auto/Cascade and Start/Stop
- Pump unit status (faults, interlock, available)

3.2 Start / stop sequence description for a Centrifugal pump unit (PU_CENT)

Start sequence is launched upon start command

Stop sequence is launched upon stop command or equipment fault or safety bar trip

3.2.1 Start sequence

- Pump start-up
- XV open after check of pump start-up and a time delay

3.2.2 Stop sequence

- Pump stop and XV close

3.3 Start/stop sequence description for a Centrifugal pump unit with SDV only (PU_CENT_1SDV)

3.3.1 Start sequence

- Pump start-up

3.3.2 Stop sequence

- Pump stop

3.4 Start/stop sequence description for a Centrifugal pump unit with XV only (PU_CENT_1XV)

3.4.1 Start sequence

- Pump start-up
- XV open after check of pump start-up and a time delay

3.4.2 Stop sequence

- Pump stop

3.5 Start/stop sequence description for a Centrifugal pump unit with XV suction and discharge valves (PU_CENT_2XV)

3.5.1 Start sequence

- Suction XV open
- Pump start-up after check of XV open
- Discharge XV open after check of pump start-up and a time delay

3.5.2 Stop sequence

- Pump stop and discharge XV close
- Suction XV close after check of discharge XV close

3.6 Start/stop sequence description for Reciprocating pump unit (PU_RECIP)

3.6.1 Start sequence

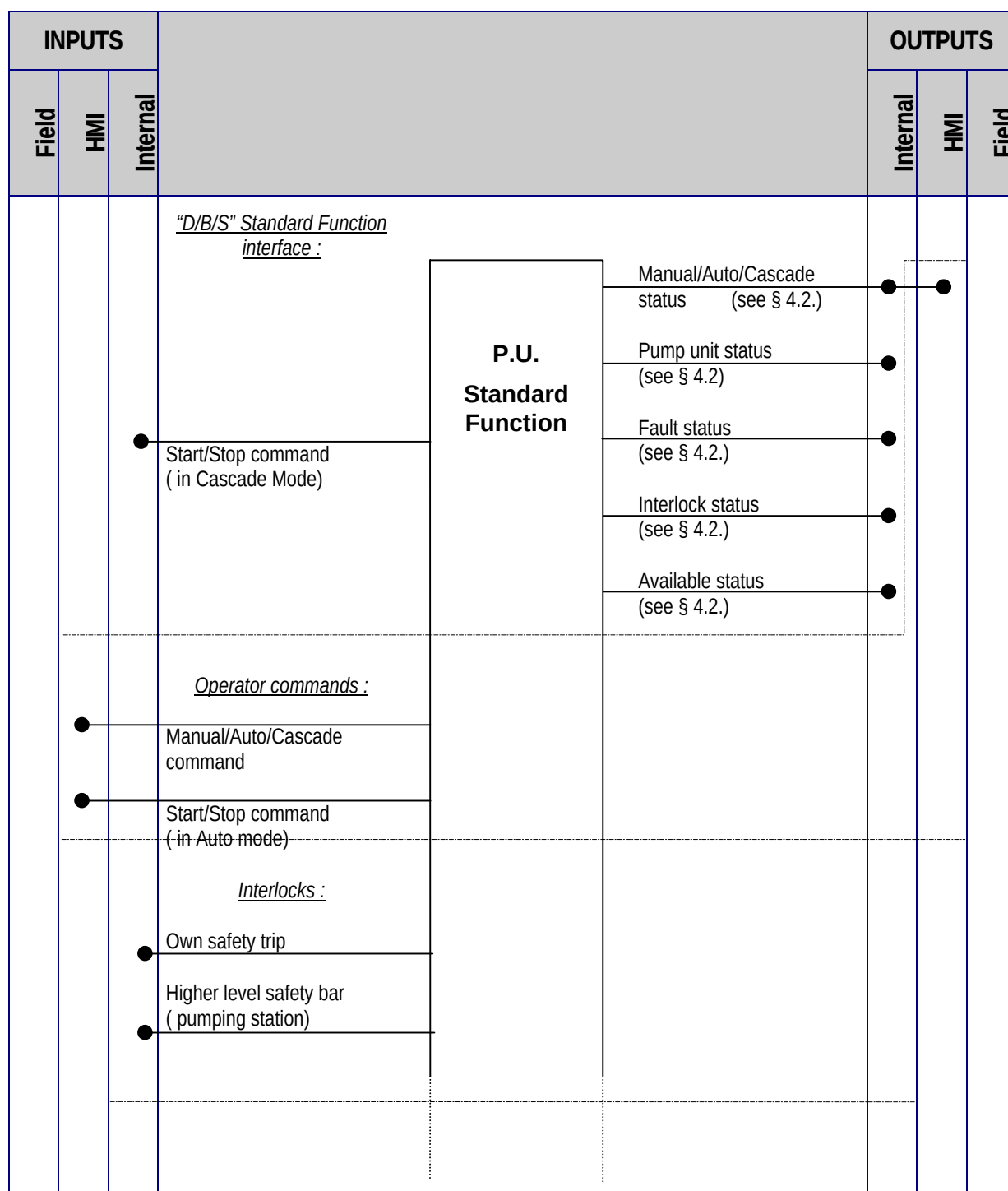
- XV open
- Pump start-up after check of XV open

3.6.2 Stop sequence

- Pump stop
- XV close after check of pump stop and a time delay

4. Interface description

4.1 General description



INPUTS				OUTPUTS		
Field	HMI	Internal		Internal	HMI	Field
		<u>SDV, XV, MOTOR Standard Functions</u> : ● SDV Status (open)	P.U. Standard Function			<u>Standard Function</u> : SDV
		● XV Status (open/closed) ● XV Discrepancy		<u>Standard Function</u> : XV_2M ● XV Standalone/Cascade mode ● XV Open/Close command (only in cascade mode)		
		● MOTOR Status (running/stopped) ● MOTOR Discrepancy ● MOTOR Available		<u>Standard Function</u> : MOT or MOT_BK ● MOTOR Standalone/Cascade mode ● MOTOR Start/Stop command (in cascade mode)		

4.2 Status description (status)

These data are used to handle the "D/B/S" Standard Function

4.2.1 Pump unit status :

- Unavailable stopped :

SDV status <> open, XV discrepancy, MOTOR unavailable or MOTOR discrepancy

- Available stopped :

SDV status = open, MOTOR stopped, XV closed and no safety trip

- Start-up :

MOTOR started and XV not yet open

- Running :

MOTOR started and XV open

4.2.2 Fault status :

To report a faulty equipment (SDV, MOTOR, XV) :

SDV status <> open, XV discrepancy, MOTOR unavailable or MOTOR discrepancy

4.2.3 Interlock status :

- Own safety bar tripped
- High level safety bar tripped

4.2.4 Manual/Auto/Cascade status :

To report if pump unit is interlocked with the D/B/S Standard Function

4.2.5 Available status :

To report if pump unit is available for start-up or stop sequences :

Active when Cascade status and (Available stopped, start-up or running status) are active

5. Detailed description of functions

5.1 Modes and commands

5.1.1 Specific description

5.1.1.1 Manual/Auto/Cascade mode

The Manual mode does not allow to launch the start /stop sequence.

The Auto mode allows the operator to launch the start/stop sequence.

The Cascade mode allows this sequence to be launched by the D/B/S Standard Function only.

Upon own pump unit safety bar tripped (or pump unit fault when in cascade mode), Manual/Auto/Cascade mode is forced to Auto mode (Manual and cascade commands are no longer available to the operator).

Discrimination with a trip issued from a higher level safety bar is also required, since in this case Manual/Auto/Cascade mode is not changed. (discrimination can be done through the first-up initiator analysis for the own pump unit safety bar)

Cascade mode is not available if the "D/B/S" function is not implemented.

5.1.1.2 Start/Stop command

Start/Stop command is available to the operator when pump unit is in Auto.

Start/Stop command is initiated by "D/B/S" Standard Function when pump unit is in Cascade.

Start/Stop command is forced to Stop upon :

- Pump unit fault
- Pump unit safety bar trip

5.2 Sequential function chart generalities

5.2.1 Conventions

TERM USED	DESCRIPTION
OPEN(CLOSE) XV	Valve XVnnnnl open (close)
OPEN(CLOSE) XV with checking	Valve XVnnnnl open (close) with status feedback checking (xZH/L)
START(STOP) MOTOR	Pump Pnnnnl start-up (stop)
START(STOP) MOTOR with checking	Pump Pnnnnl start-up (stop) with status feedback checking (MYH/L)
START-UP TIMER Tln	Timer, initiated with preset value (seconds)

5.2.2 Term description

Timer Tro (XV open) : XV discharge valve open time delay after pump start-up

Timer Tfm (fault masking) : fault masking time upon an equipment (SDV, MOTOR, XV) fault detection

Timer Txc (XV close) : XV discharge valve close time delay after pump stop

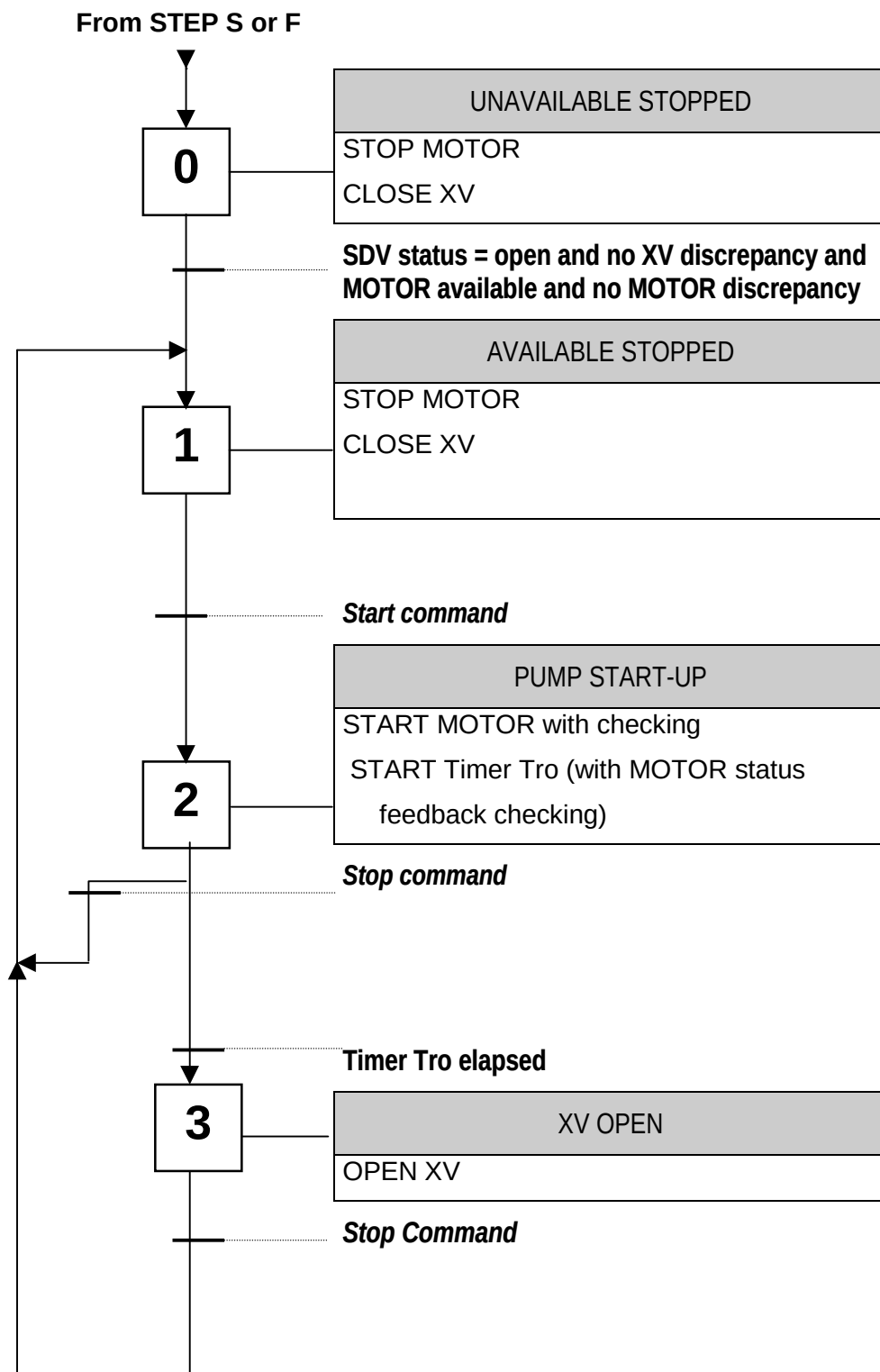
Timer Tsxc (XV close) : XV suction valve close time delay after pump stop

5.2.3 Initial chart step and mode

Sequential function chart is set to Step MANUAL and Manual/Auto/Cascade command is set to Manual

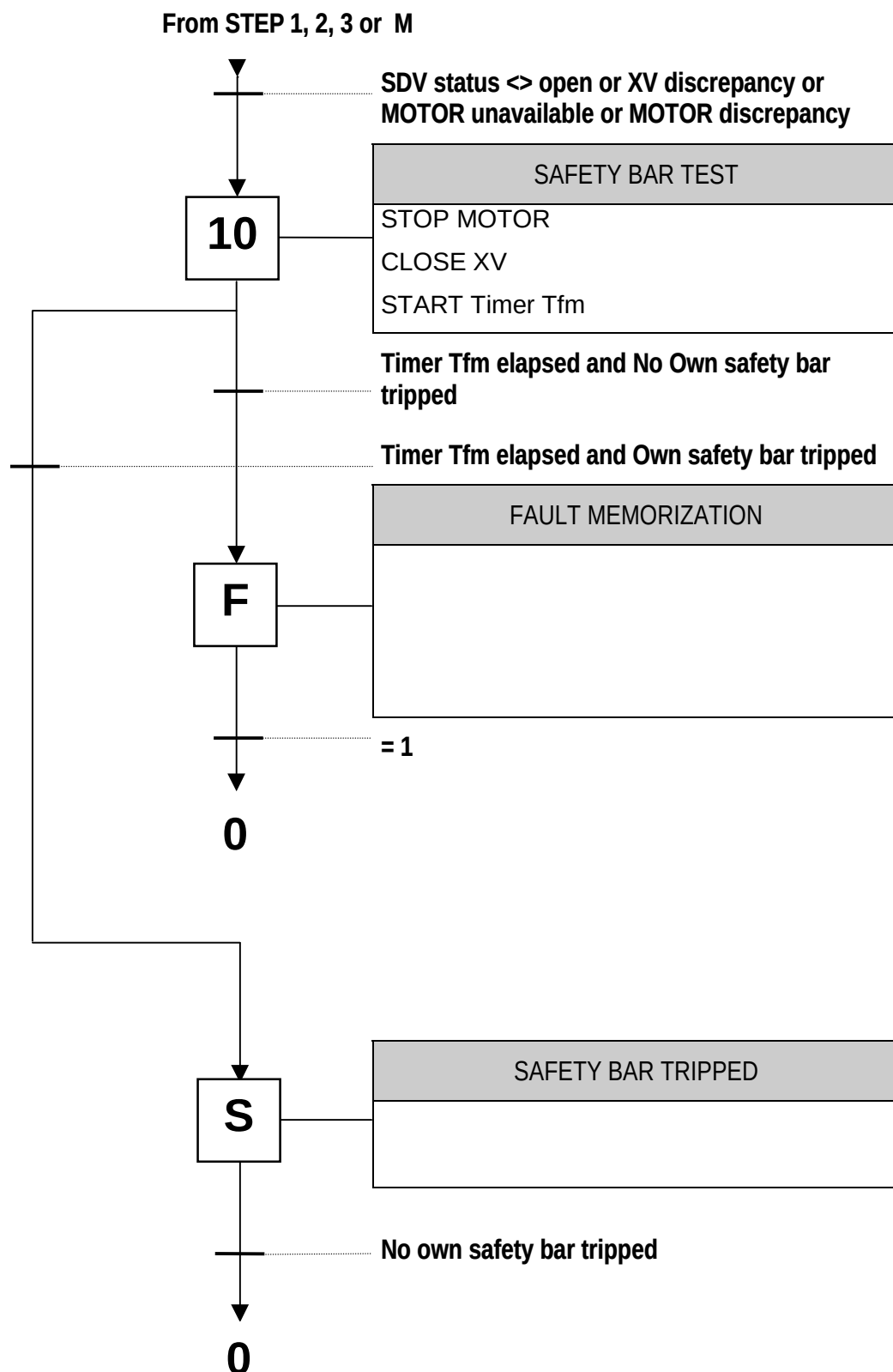
5.3 Sequential chart of centrifugal pump unit (PU_CENT)

5.3.1 Start/Stop chart



5.3.2 Safety Bar tripped or fault chart

5.3.2.1 Chart



5.3.2.2 Purpose of STEP 10

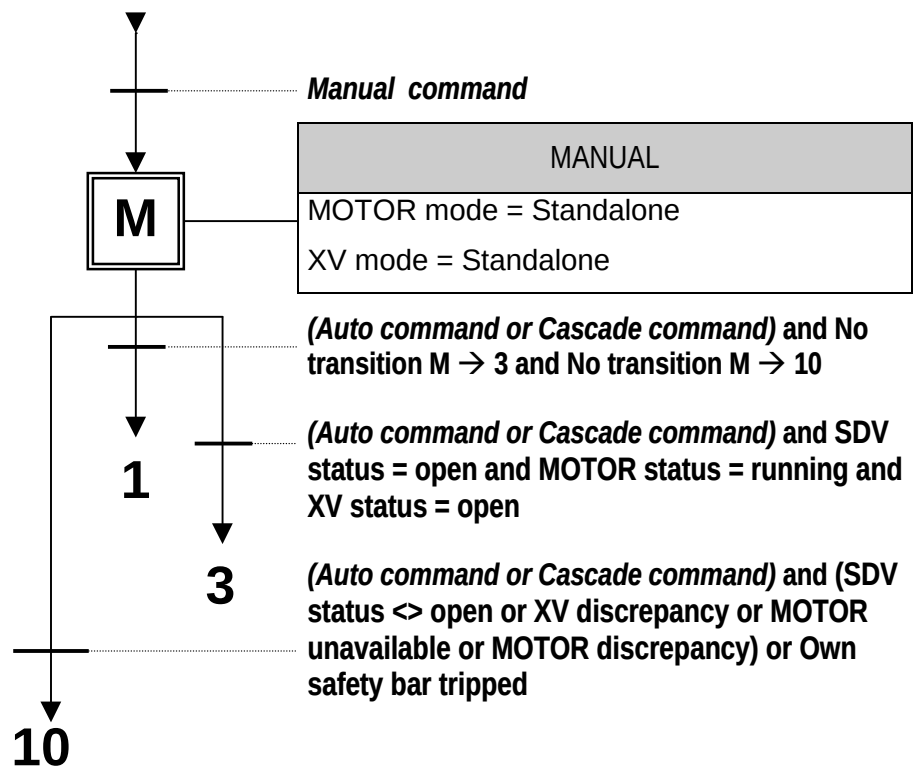
Safety Stop order of the motor (generally from the PSS) and own pump unit fault (Emergency stop or electric fault) will affect the available status of the motor..

The discrimination between a Safety Stop command and a own fault is required for the correct progress of the sequential chart : Upon an equipment fault detection (e.g. motor in unavailable status), the Sequential Function Chart is set to STEP 10 to wait the necessarily time to determine the cause of the trip : own pump unit fault or safety bar (whose status is updated by means of the network, after a communication time delay).

When the time is elapsed, the Sequential Function Chart will be set to F step (in case of own fault) or to S step (in case of Safety bar tripped).

5.3.3 Auto/Manual chart

From STEP 0, 1, 2 or 3





5.4 Sequential chart of Centrifugal pump unit with SDV only (PU_CENT_1SDV)

5.4.1 Status description

5.4.1.1 Pump unit status :

- Unavailable stopped :

SDV status <> open, MOTOR unavailable or MOTOR discrepancy

- Available stopped :

SDV status = open, MOTOR stopped and no safety bar tripped

- Running :

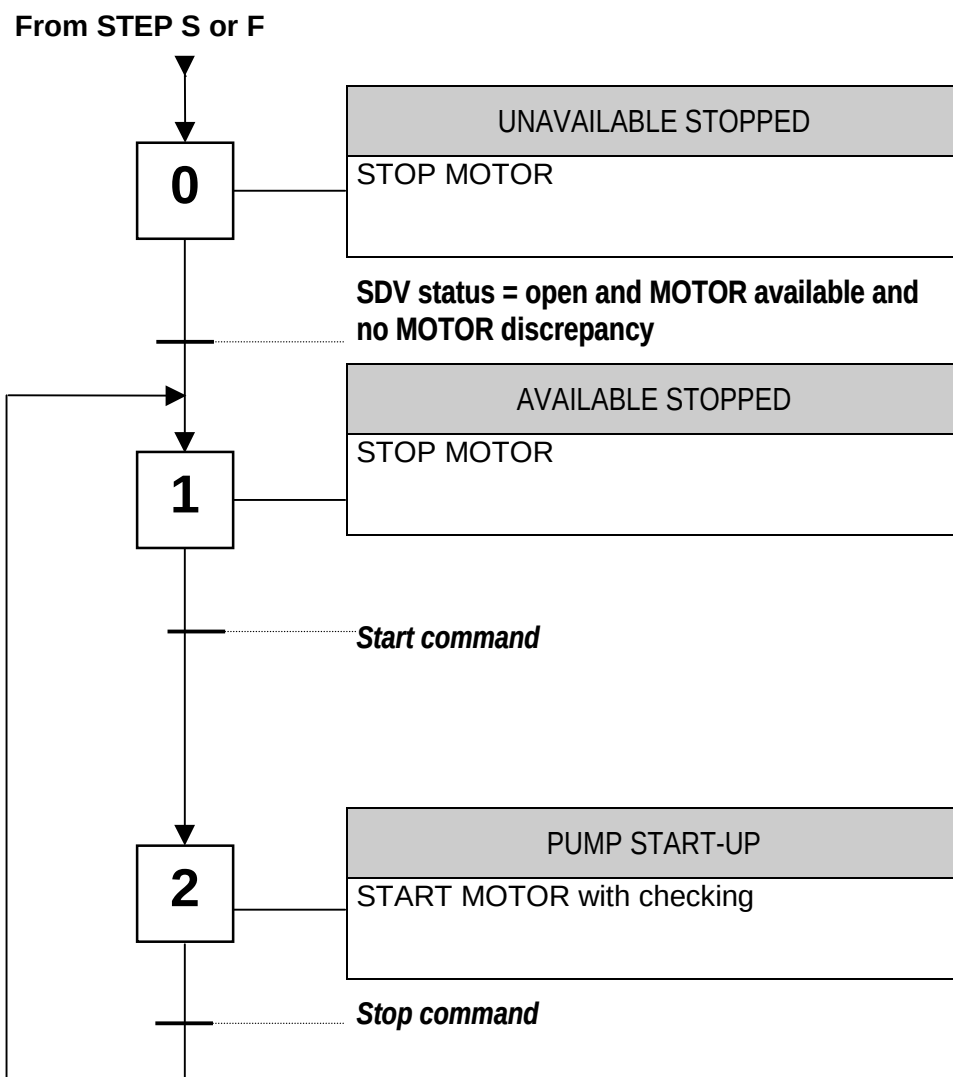
MOTOR started

5.4.1.2 Fault status :

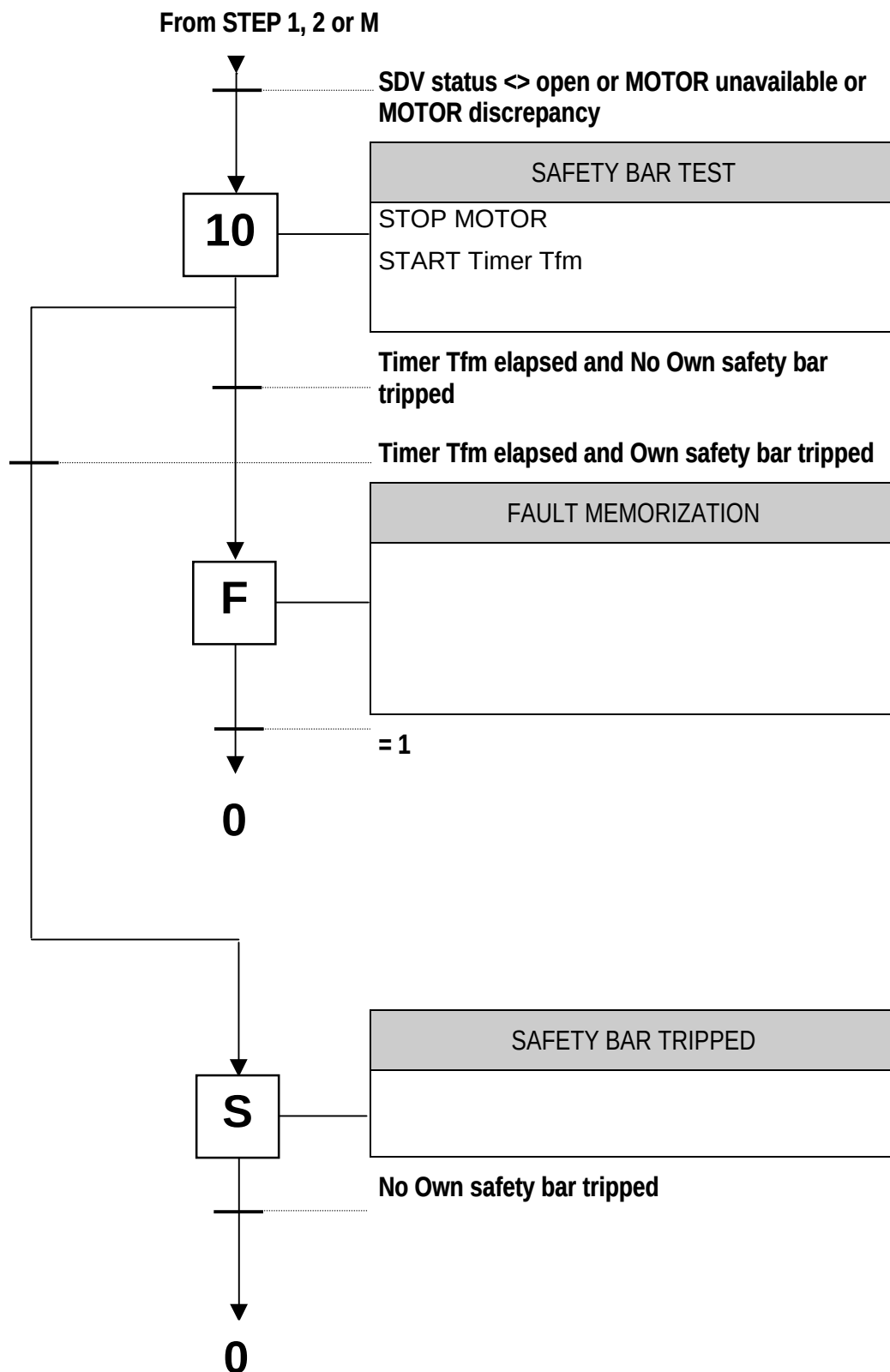
To report a faulty equipment (SDV, MOTOR) :

SDV status <> open, MOTOR unavailable or MOTOR discrepancy

5.4.2 Start/Stop chart

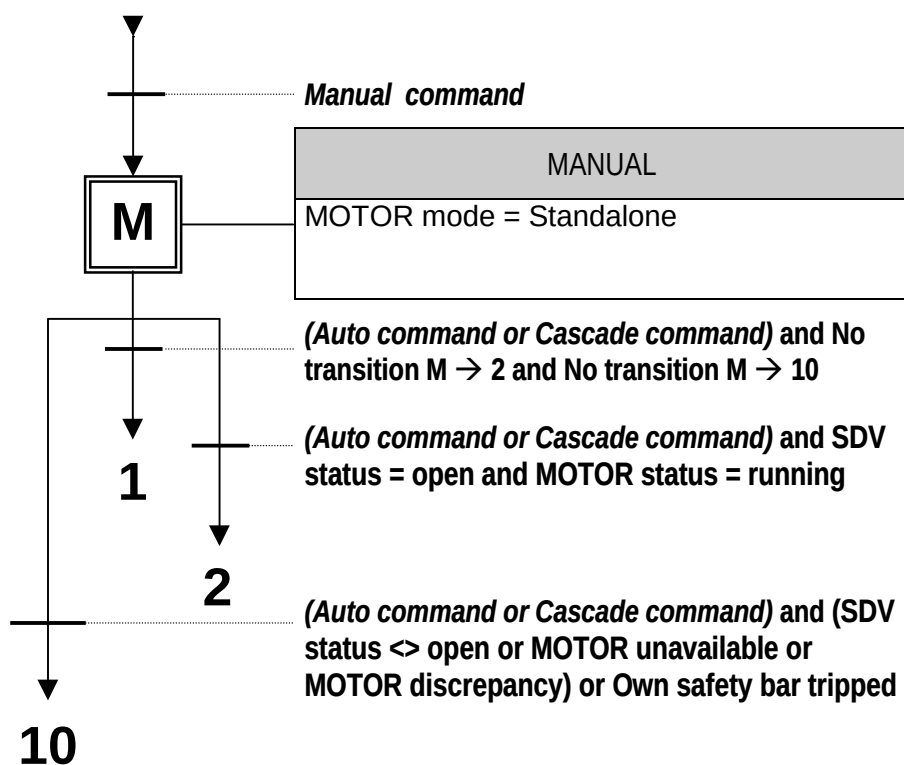


5.4.3 Safety Bar tripped or fault chart



5.4.4 Auto/Manual chart

From STEP 0, 1 or 2



5.4.5 Miscellaneous

There is no Timer Tro (XV open)



5.5 Sequential chart of Centrifugal pump unit with only XV (PU_CENT_1XV)

5.5.1 Status description

5.5.1.1 Pump unit status :

- Unavailable stopped :

XV discrepancy, MOTOR unavailable or MOTOR discrepancy

- Available stopped :

XV closed, MOTOR stopped and no safety bar tripped

- Start-up :

MOTOR started and XV closed

- Running :

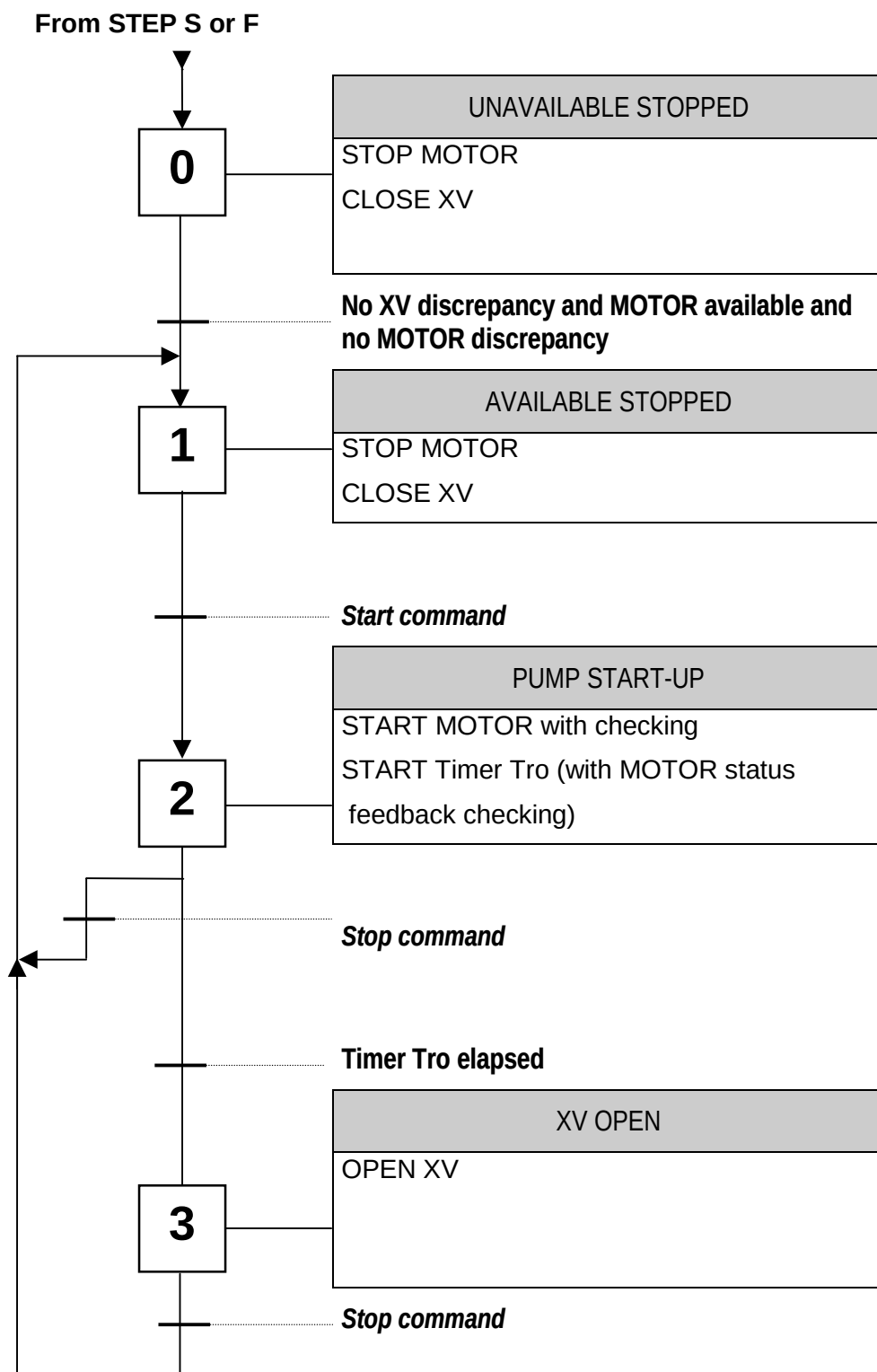
MOTOR started and XV open

5.5.1.2 Fault status :

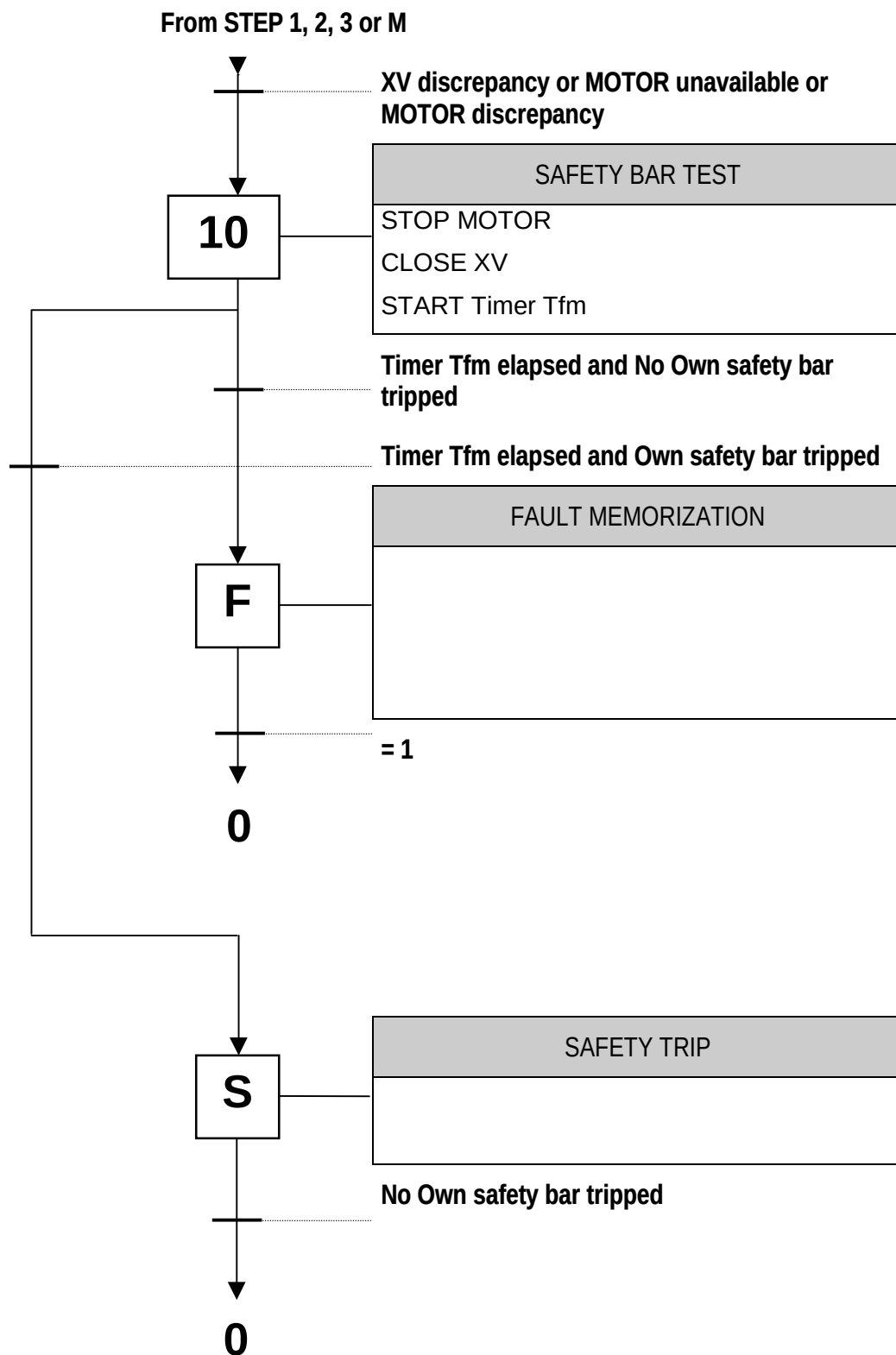
To report a faulty equipment (XV, MOTOR) :

XV discrepancy, MOTOR unavailable or MOTOR discrepancy

5.5.2 Start/Stop chart

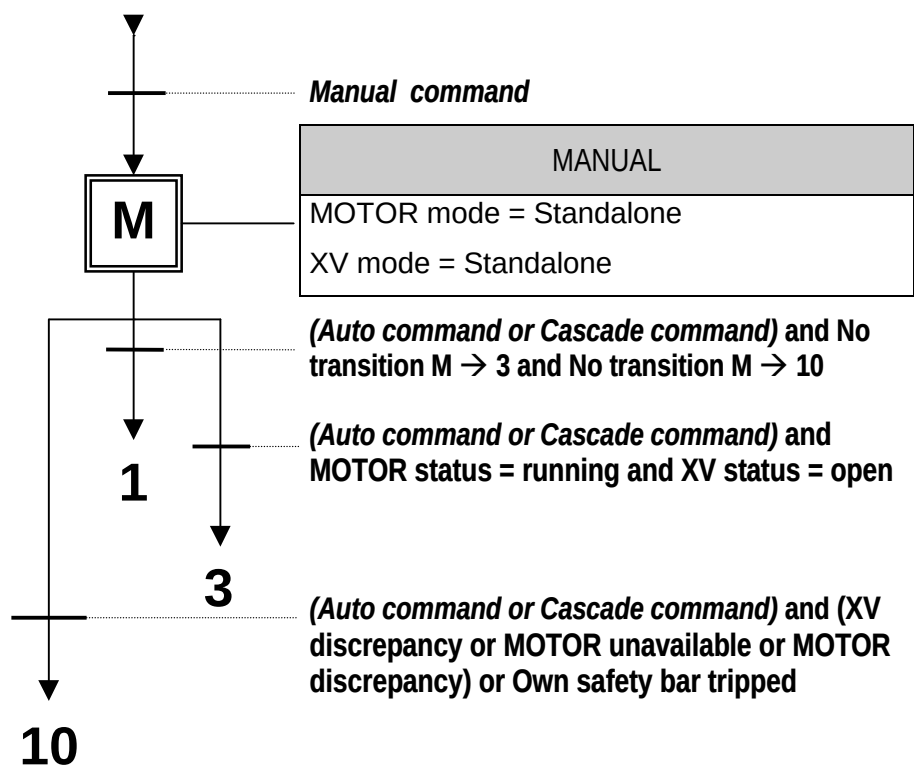


5.5.3 Bar tripped or fault chart



5.5.4 Auto/Manual chart

From STEP 0,1, 2, 3 or 4





5.6 Sequential chart of centrifugal pump unit with XV Suction and Discharge valves (PU_CENT_2XV)

5.6.1 Status description

5.6.1.1 Pump unit status :

- Unavailable stopped :

Suction XV discrepancy or Discharge XV discrepancy or MOTOR unavailable or MOTOR discrepancy

- Available stopped :

Suction XV closed, Discharge XV closed, MOTOR stopped and no safety bar tripped

- Start-up :

MOTOR started and Discharge XV closed

- Running :

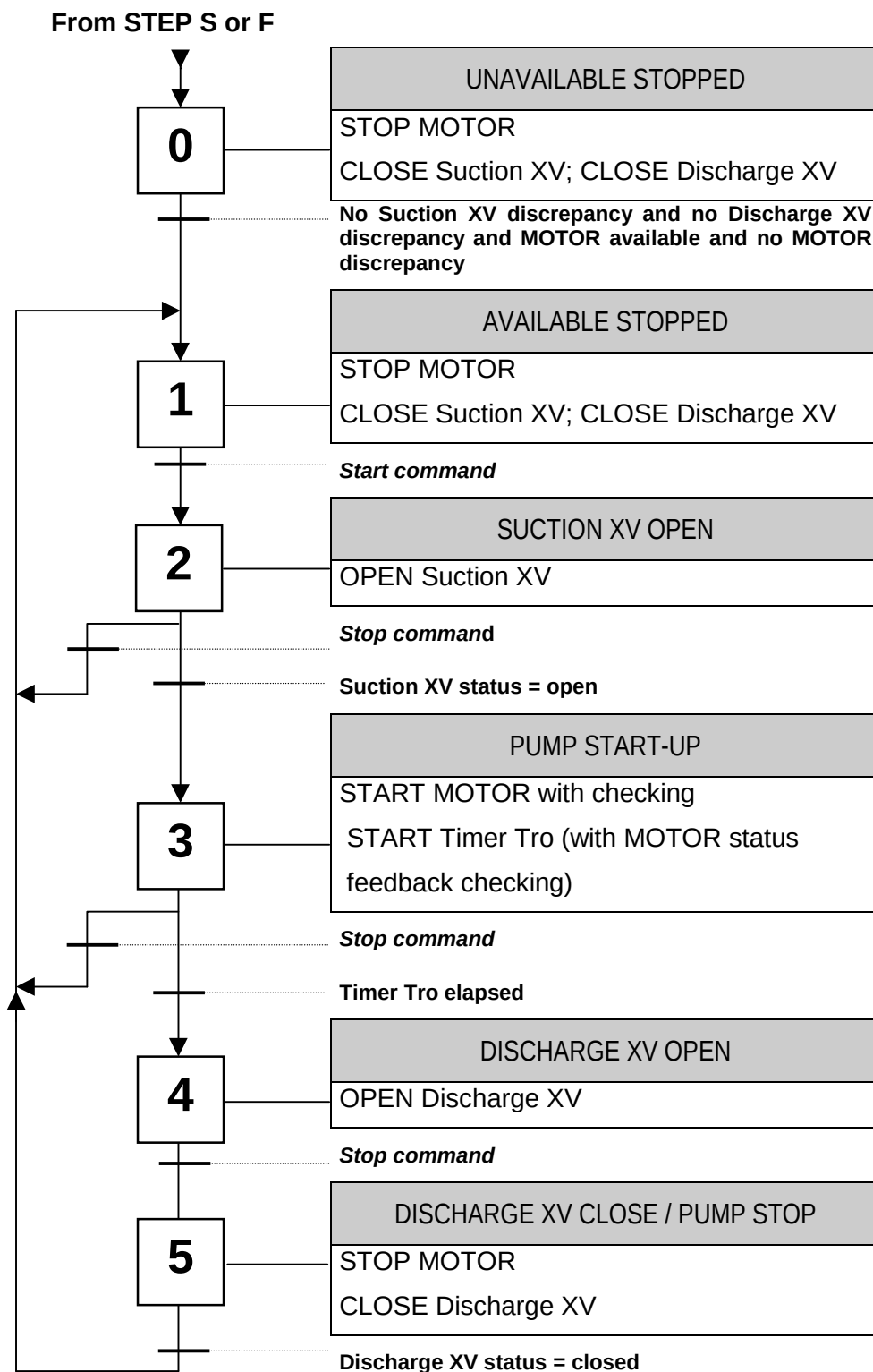
MOTOR started and Discharge XV open

5.6.1.2 Fault status :

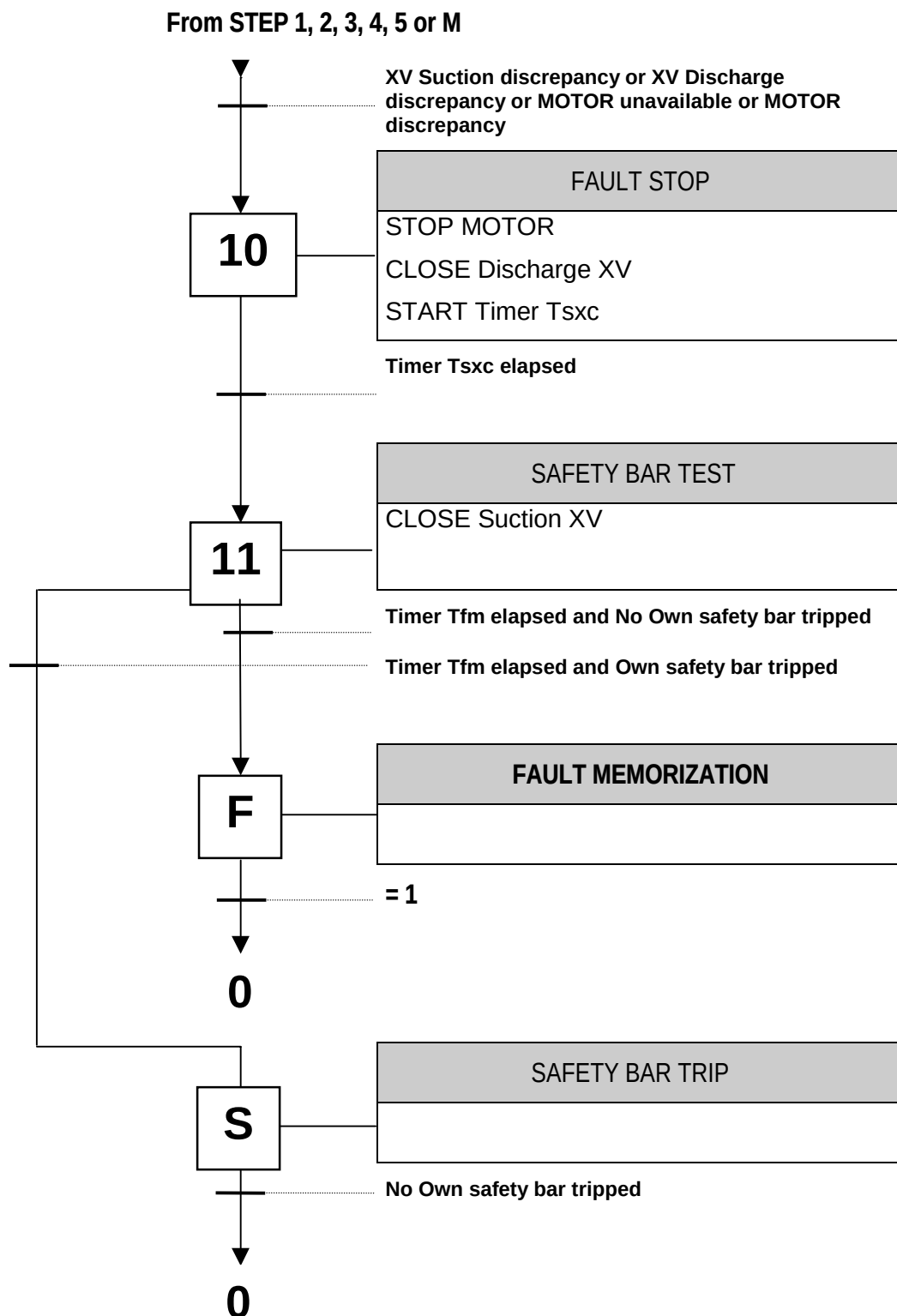
To report a faulty equipment (XV, MOTOR) :

Suction XV discrepancy, Discharge XV discrepancy, MOTOR unavailable or MOTOR discrepancy

5.6.2 Start/Stop chart

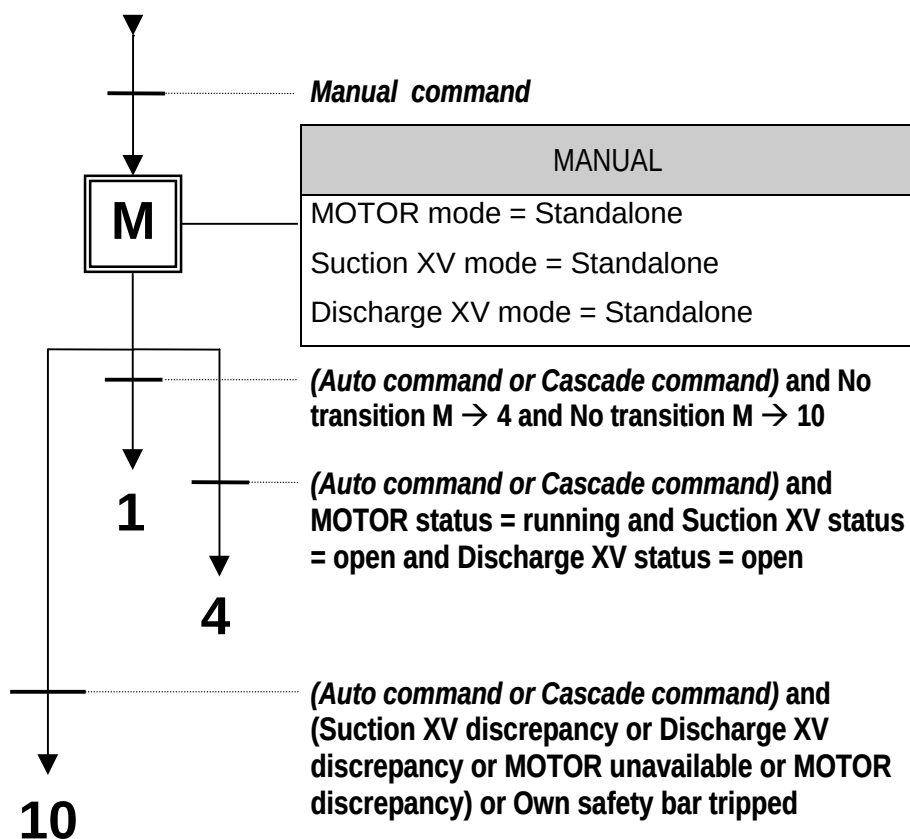


5.6.3 Bar tripped or fault chart



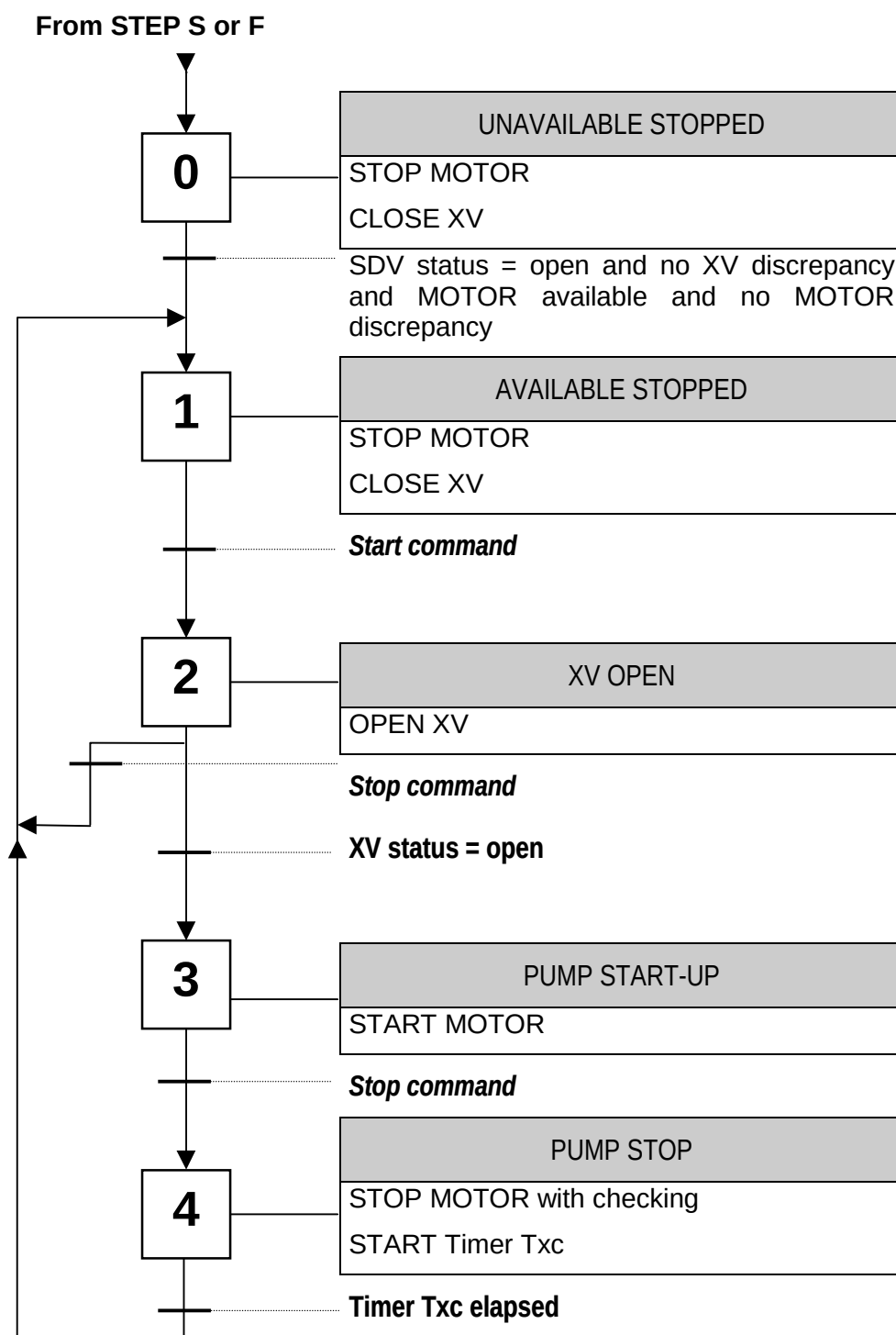
5.6.4 Auto/Manual chart

From STEP 0, 1, 2, 3, 4 or 5

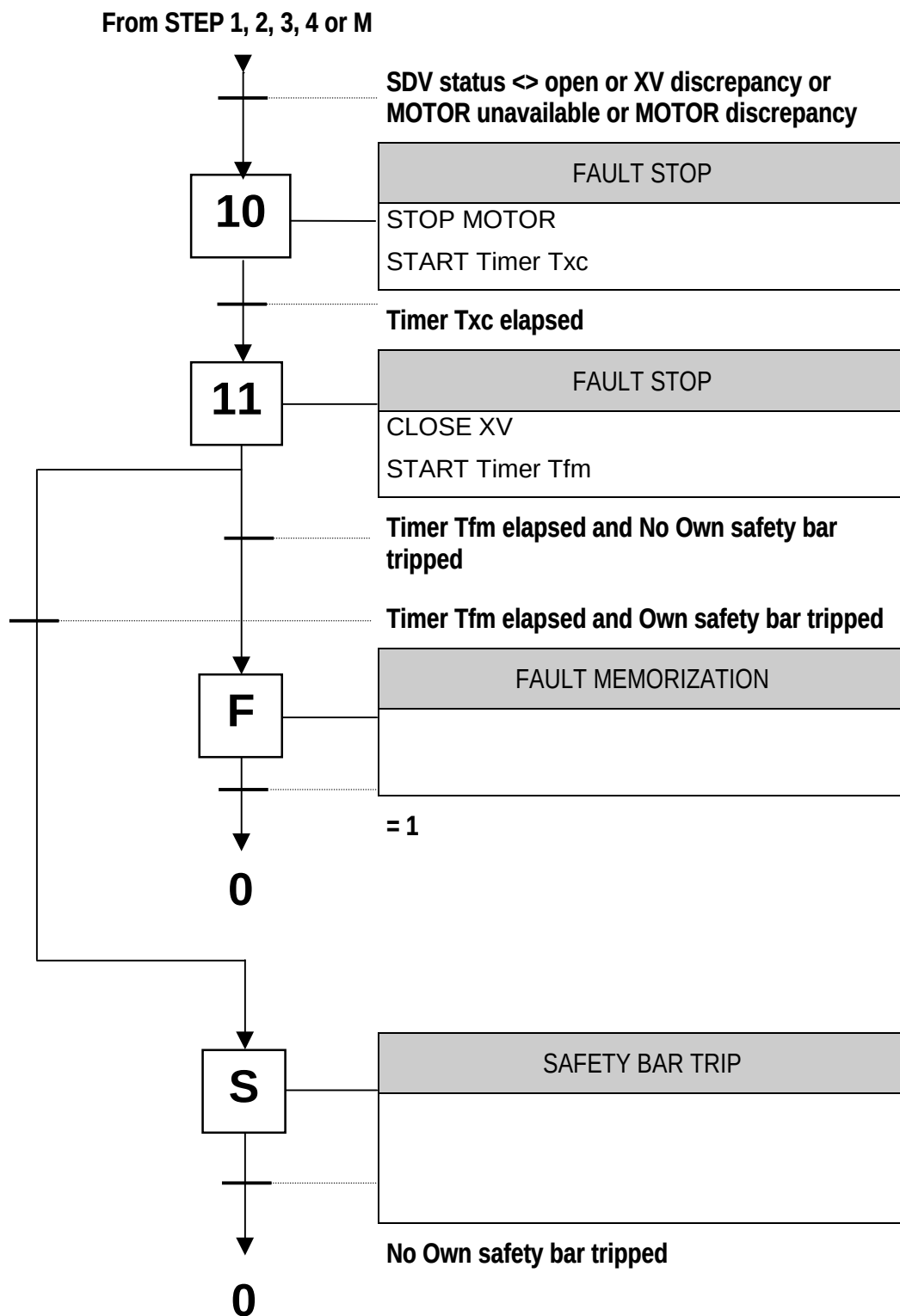


5.7 Sequential chart of Reciprocating pump unit (PU_RECIP)

5.7.1 Start/Stop chart

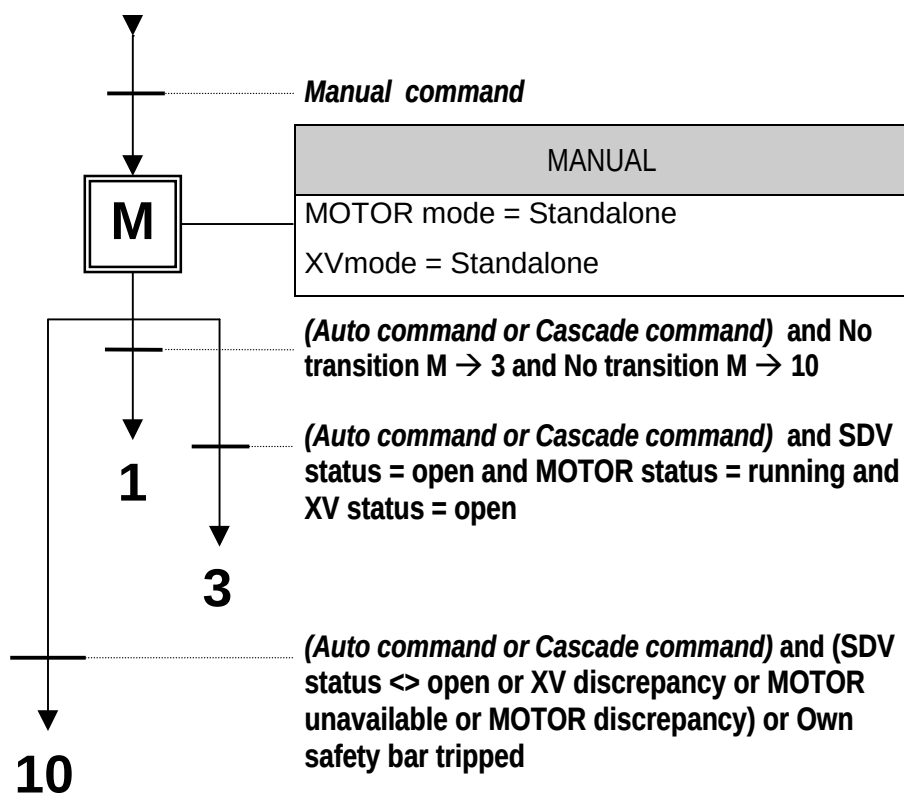


5.7.2 Bar tripped or fault chart



5.7.3 Auto/Manual chart

From STEP 0, 1, 2, 3 or 4



6. Tuning parameters and variables

6.1 Centrifugal pump unit

PARAMETER	ACCESS LEVEL
Timer Tro preset value	Method
Timer Tfm preset value	Method
Timer Tsvc preset value (PU_CENT_2XV)	Method

6.2 Reciprocating pump unit

PARAMETER	ACCESS LEVEL
Timer Txc preset value	Method
Timer Tfm preset value	Method

7. Representation and animation description (HMI)

7.1 Events and values to be recorded

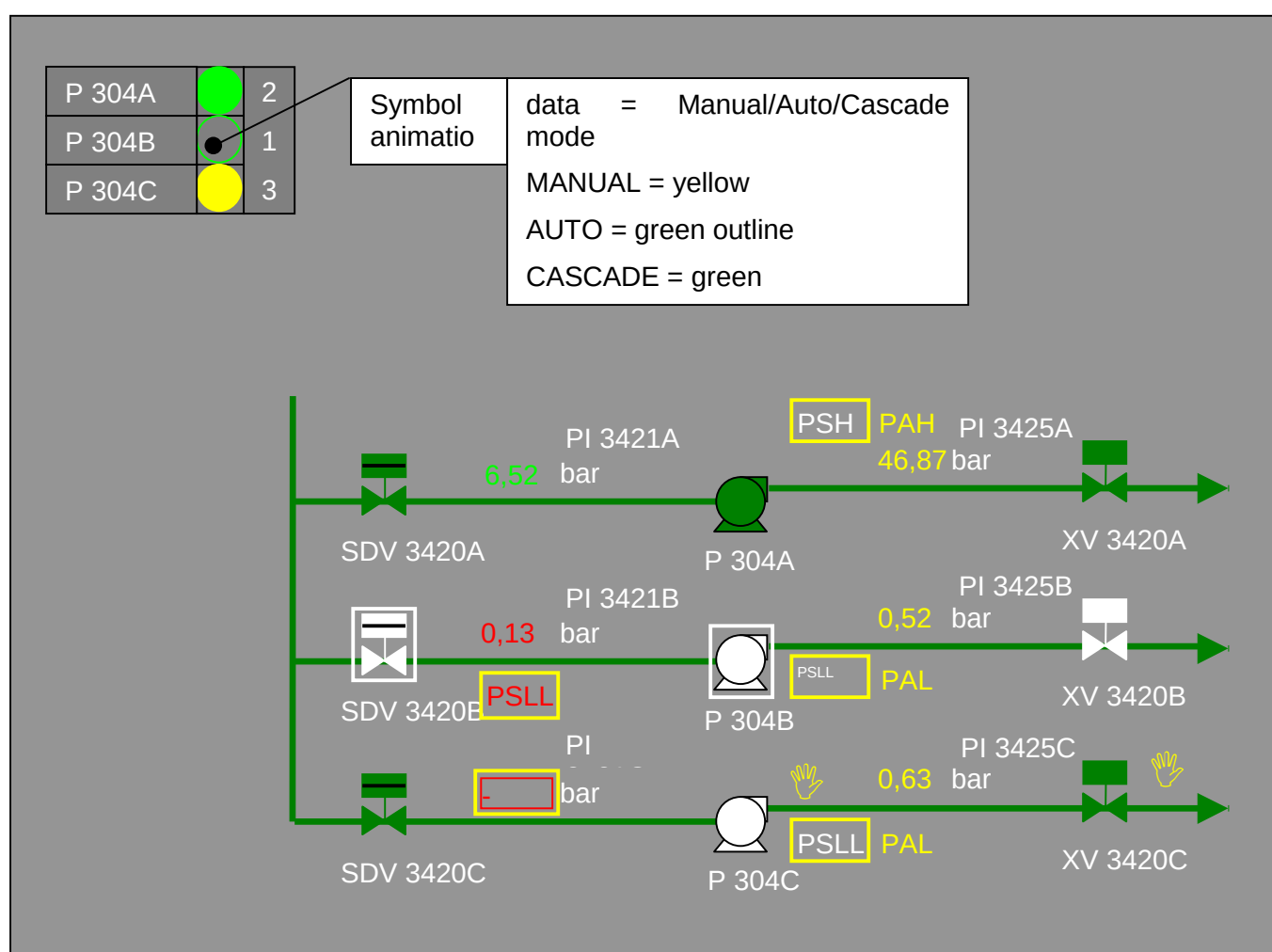
7.1.1 Events

- Manual/Auto/Cascade command
- Start/Stop command (operator)

7.2 Process control display (operating level display)

The hereafter description gives examples of representation. However, they may be amended dependant on the DCS features.

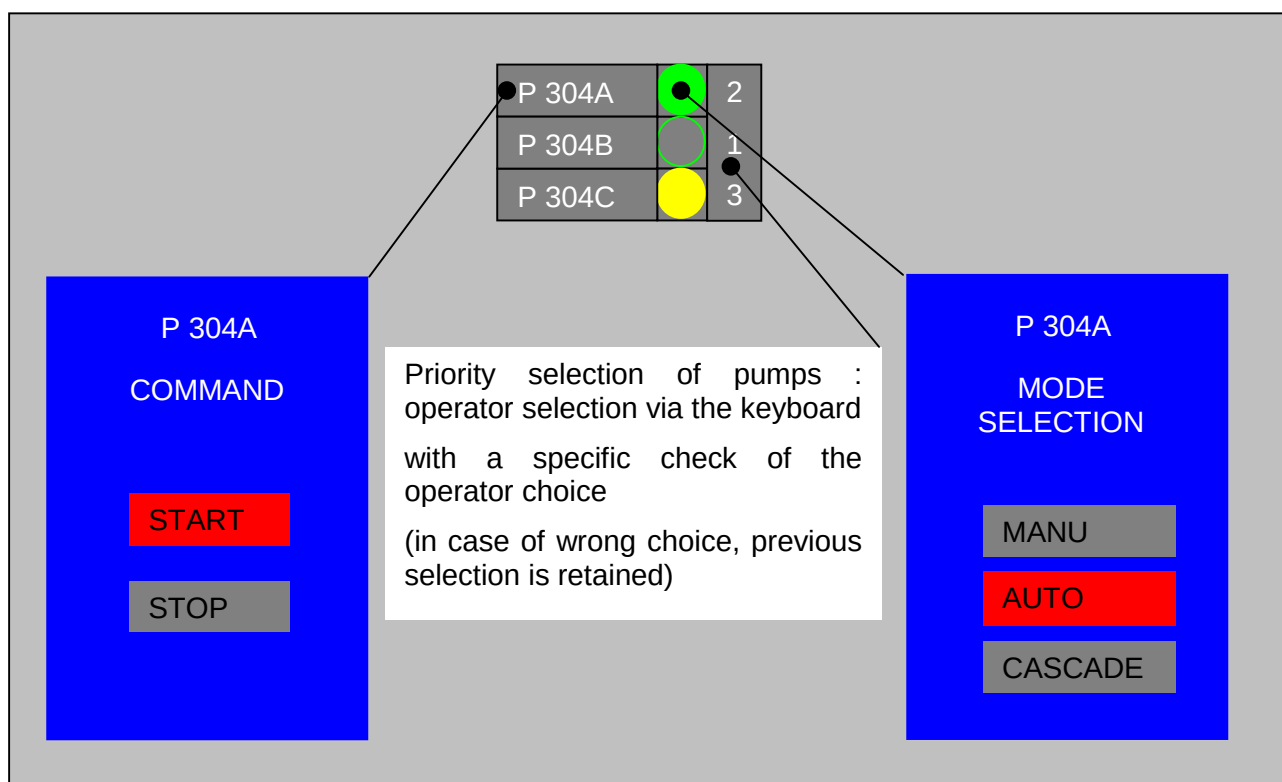
7.2.1 General description of centrifugal pump unit



7.2.2 Animation description of equipment

Concerning SDV, MOTOR and XV equipment, animation is described in corresponding equipment Standard Function

7.2.3 Access of commands for a pump unit



Priority selection of pumps is described in D/B/S Standard Function

8. Appendix: handling of status in case of centrifugal pump unit (PU_CENT)

STEP CHART	Auto/Manual status	Pump unit status	Fault status	Interlock (Safety locking) status	Available status
STEP 0		= Unavailable stopped			= Unavailable
STEP 1	= Auto or = Cascade	= Available stopped	= No Fault	= Normal	= Available
STEP 2		= Start-up			= Available
STEP 3	= Auto or = Cascade	= Running (If XV status = Open)	= No Fault		= Available
STEP S	= Auto locked If own safety bar tripped Else = Auto or = Cascade	= /	= Fault If own safety bar tripped	= Upstream SB tripped If Upstream SB tripped Else = Own SB tripped	= Unavailable
STEP M	= Manual	= /			= Unavailable
STEP F		= /	= Fault		= Unavailable
STEP 10	= Auto or = Cascade	= /			= Unavailable