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ROMPS CRITICAL DESIGN REVIEW
Volume III–Furnace Module Design Documentation

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FURNACE MODULE DESIGN DOCUMENTATION

EASYLAB PROGRAMS
DEFINITIONS

FURNACE MODULE
EASYLAB COMMAND VARIABLES

Space Automated Research Center (SpARC)

December 3, 1992

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NAME: **F:POWER**

SYNTAX: F:POWER = *x* or ? F:POWER

x = power level in watts

0<= *x* <= 255

DESCRIPTION: SET POWER LEVEL
COMMANDCODE #1

Set the power level of the furnace or get the current power setting from the furnace controller. The power setting can be queried only if the last furnace setting was for power. If the last furnace setting was for temperature, this command returns an error.

EXAMPLE: F:POWER = 50

? F:POWER
5 0

NAME: **F:TEMPERATURE**

SYNTAX: F:TEMP = *x* or ? F:TEMP

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE
COMMANDCODE #2

Set the temperature of the furnace or get the current temperature setting from the furnace controller. The temperature setting can be queried only if the last furnace setting was for temperature. If the last furnace setting was for power, this command returns an error.

EXAMPLE: F:TEMP = 1000

? F:TEMP
1000

NAME: **F:POWER.PROFILE.1**

SYNTAX: F:POWER.PROFILE.1 = *x* or ? F:POWER.PROFILE.1

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 1
COMMANDCODE #3

Set or return the power level for step 1 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.1
5 0
```

NAME: **F:POWER.PROFILE.2**

SYNTAX: F:POWER.PROFILE.2 = *x* or ? F:POWER.PROFILE.2

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 2
COMMANDCODE #4

Set or return the power level for step 2 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.2
100
```

NAME: F:POWER.PROFILE.3

SYNTAX: F:POWER.PROFILE.3 = *x* or ? F:POWER.PROFILE.3

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 3
COMMANDCODE #5

Set or return the power level for step 3 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.3
200
```

NAME: **F:POWER.PROFILE.4**

SYNTAX: F:POWER.PROFILE.4 = *x* or ? F:POWER.PROFILE.4

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 4
COMMANDCODE #6

Set or return the power level for step 4 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.4
250
```

NAME: **F:POWER.PROFILE.5**

SYNTAX: F:POWER.PROFILE.5 = *x* or ? F:POWER.PROFILE.5

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 5
COMMANDCODE #7

Set or return the power level for step 5 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.5
200
```

NAME: **F:POWER.PROFILE.6**

SYNTAX: F:POWER.PROFILE.6 = *x* or ? F:POWER.PROFILE.6

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 6
COMMANDCODE #8

Set or return the power level for step 6 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.6
100
```

NAME: **F:POWER.PROFILE.7**

SYNTAX: F:POWER.PROFILE.7 = *x* or ? F:POWER.PROFILE.7

x = power level in watts

0 <= *x* <= 255

DESCRIPTION: SET POWER PROFILE STEP 7
COMMANDCODE #9

Set or return the power level for step 7 of a power profile. Power profiles consist of seven power/time steps. For each step, the power level of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 250
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 200
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:POWER.PROFILE.7
0
```

NAME: **F:TEMP.PROFILE.1**

SYNTAX: F:TEMP.PROFILE.1 = *x* or ? F:TEMP.PROFILE.1

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 1
COMMANDCODE #10

Set or return the temperature for step 1 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.1
100
```

NAME: **F:TEMP.PROFILE.2**

SYNTAX: F:TEMP.PROFILE.2 = *x* or ? F:TEMP.PROFILE.2

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 2
COMMANDCODE #11

Set or return the temperature for step 2 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.2
200
```

NAME: **F:TEMP.PROFILE.3**

SYNTAX: F:TEMP.PROFILE.3 = *x* or ? F:TEMP.PROFILE.3

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 3
COMMANDCODE #12

Set or return the temperature for step 3 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.3
1000
```

NAME: **F:TEMP.PROFILE.4**

SYNTAX: F:TEMP.PROFILE.4 = *x* or ? F:TEMP.PROFILE.4

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 4
COMMANDCODE #13

Set or return the temperature for step 4 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.4
1500
```

NAME: **F:TEMP.PROFILE.5**

SYNTAX: F:TEMP.PROFILE.5 = *x* or ? F:TEMP.PROFILE.5

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 5
COMMANDCODE #14

Set or return the temperature for step 5 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.5
800
```

NAME: **F:TEMP.PROFILE.6**

SYNTAX: F:TEMP.PROFILE.6 = *x* or ? F:TEMP.PROFILE.6

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 6
COMMANDCODE #15

Set or return the temperature for step 6 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.6
400
```

NAME: **F:TEMP.PROFILE.7**

SYNTAX: F:TEMP.PROFILE.7 = *x* or ? F:TEMP.PROFILE.7

x = temperature in degrees Celsius

0 <= *x* <= 1600

DESCRIPTION: SET TEMPERATURE PROFILE STEP 7
COMMANDCODE #16

Set or return the temperature for step 7 of a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 200
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 400
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TEMPERATURE.PROFILE.7
0
```

NAME: **F:TIME.PROFILE.1**

SYNTAX: F:TIME.PROFILE.1 = *x* or ? F:TIME.PROFILE.1

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 1
COMMANDCODE #17

Set or return the time for step 1 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 100
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 400
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 1000
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1200
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 800
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 200
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TIME.PROFILE.1
6 0
```

NAME: **F:TIME.PROFILE.2**

SYNTAX: F:TIME.PROFILE.2 = *x* or ? F:TIME.PROFILE.2

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 2
COMMANDCODE #18

Set or return the time for step 2 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 250
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 500
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 750
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 1500
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 1000
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 500
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TIME.PROFILE.2
120
```

NAME: **F:TIME.PROFILE.3**

SYNTAX: F:TIME.PROFILE.3 = *x* or ? F:TIME.PROFILE.3

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 3
COMMANDCODE #19

Set or return the time for step 1 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 350
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 450
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 770
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 900
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 1200
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 670
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 200
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TIME.PROFILE.3
120
```

NAME: F:TIME.PROFILE.4

SYNTAX: F:TIME.PROFILE.4 = *x* or ? F:TIME.PROFILE.4

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 4
COMMANDCODE #20

Set or return the time for step 4 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 50
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 100
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 200
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 230
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 220
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 170
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:TIME.PROFILE.4
300
```

NAME: F:TIME.PROFILE.5

SYNTAX: F:TIME.PROFILE.5 = *x* or ? F:TIME.PROFILE.5

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 5
COMMANDCODE #21

Set or return the time for step 5 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 440
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 460
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 500
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 530
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 550
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 300
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 120
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE

? F:TIME.PROFILE.5
300
```

NAME: **F:TIME.PROFILE.6**

SYNTAX: F:TIME.PROFILE.6 = *x* or ? F:TIME.PROFILE.6

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 6
COMMANDCODE #22

Set or return the time for step 6 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 20
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 30
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 40
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 50
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 70
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 30
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 10
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:TIME.PROFILE.6
120
```

NAME: **F:TIME.PROFILE.7**

SYNTAX: F:TIME.PROFILE.7 = *x* or ? F:TIME.PROFILE.7

x = time in seconds

DESCRIPTION: SET TIME PROFILE STEP 7
COMMANDCODE #23

Set or return the time for step 1 of a power or temperature profile. Power and temperature profiles each consist of seven power/time or temperature/time steps. For each step, the power or temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power or temperature profile is finished.

EXAMPLE:

```
F:POWER.PROFILE.1 = 35
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 60
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 120
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 150
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 255
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 100
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE

? F:TIME.PROFILE.7
60
```

NAME: F:EXECUTE.TEMP.PROFILE

SYNTAX: F:EXECUTE.TEMP.PROFILE

DESCRIPTION: EXECUTE TEMPERATURE PROFILE
COMMANDCODE #24

Execute a temperature profile. Temperature profiles consist of seven temperature/time steps. For each step, the temperature of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the temperature profile is finished. If any temperature/time steps are undefined, they are simply not executed, and the temperature profile continues on to the next step.

EXAMPLE:

```
F:TEMPERATURE.PROFILE.1 = 200
F:TIME.PROFILE.1 = 60
F:TEMPERATURE.PROFILE.2 = 500
F:TIME.PROFILE.2 = 120
F:TEMPERATURE.PROFILE.3 = 400
F:TIME.PROFILE.3 = 120
F:TEMPERATURE.PROFILE.4 = 700
F:TIME.PROFILE.4 = 300
F:TEMPERATURE.PROFILE.5 = 1300
F:TIME.PROFILE.5 = 300
F:TEMPERATURE.PROFILE.6 = 900
F:TIME.PROFILE.6 = 120
F:TEMPERATURE.PROFILE.7 = 100
F:TIME.PROFILE.7 = 60
F:EXECUTE.TEMPERATURE.PROFILE
```

NAME: **F:EXECUTE.POWER.PROFILE**

SYNTAX: F:EXECUTE.POWER.PROFILE

DESCRIPTION: EXECUTE POWER PROFILE
COMMANDCODE #25

Execute a power profile. Power profiles consist of seven Power/time steps. For each step, the power of the furnace is set to a predefined level for a predefined amount of time. Once all seven steps have been executed, the power profile is finished. If any power/time steps are undefined, they are simply not executed, and the power profile continues on to the next step.

EXAMPLE:

```
F:POWER.PROFILE.1 = 20
F:TIME.PROFILE.1 = 60
F:POWER.PROFILE.2 = 70
F:TIME.PROFILE.2 = 120
F:POWER.PROFILE.3 = 50
F:TIME.PROFILE.3 = 120
F:POWER.PROFILE.4 = 100
F:TIME.PROFILE.4 = 300
F:POWER.PROFILE.5 = 50
F:TIME.PROFILE.5 = 300
F:POWER.PROFILE.6 = 90
F:TIME.PROFILE.6 = 120
F:POWER.PROFILE.7 = 0
F:TIME.PROFILE.7 = 60
F:EXECUTE.POWER.PROFILE
```

NAME: **F:CLEAR.PROFILE**

SYNTAX: F:CLEAR.PROFILE

DESCRIPTION: CLEAR PROFILES
COMMANDCODE #26

Clear all seven power/temperature/time profile steps.

EXAMPLE: F:CLEAR.PROFILE

NAME: **F:PGAIN**

SYNTAX: F:.PGAIN = *x* or ? F:PGAIN

x = proportional gain term (KP) for servo calculations.

0 <= *x* <= 255

DESCRIPTION: PROPORTIONAL GAIN COMMAND
COMMANDCODE #27

Define the proportional gain term (KP) used in the servo calculations for the furnace controller or get the current proportional gain term from the furnace controller.

EXAMPLE:
```
F:PGAIN = 0
? F:PGAIN
0
```

NAME: **F:IGAIN**

SYNTAX: F:IGAIN = *x* or ? F:IGAIN

x = integral gain term (KI) for servo calculations.

0 <= *x* <= 255

DESCRIPTION: INTEGRAL GAIN COMMAND
COMMANDCODE #28

Define the integral gain term (KI) used in the servo calculations for the furnace controller or get the current integral gain term from the furnace controller.

EXAMPLE:
```
F:IGAIN = 0
? F:IGAIN
0
```

NAME: **F:DGAIN**

SYNTAX: F:.DGAIN = *x* or ? F:DGAIN

x = derivative gain term (KD) for servo calculations.

0 <= *x* <= 255

DESCRIPTION: DERIVATIVE GAIN COMMAND
COMMANDCODE #29

Define the proportional gain term (KP) used in the servo calculations for the furnace controller or get the current derivative gain term from the furnace controller.

EXAMPLE:
```
F:PGAIN = 0
? F:PGAIN
0
```

NAME: **F:ILIMIT**

SYNTAX: F:.ILIMIT = *x* or ? F:ILIMIT

x = integrator limit for servo calculations.

0 <= *x* <= 255

DESCRIPTION: INTEGRATOR LIMIT COMMAND
COMMANDCODE #30

Define the integrator limit used in the servo calculations for the furnace controller get the current integrator limit from the furnace controller.

EXAMPLE:
```
F:ILIMIT = 0
? F:ILIMIT
0
```

NAME: **F:LOOPTIME**

SYNTAX: F:.LOOPTIME = *x* or ? F:LOOPTIME

x = looptime for servo calculations.

0 <= *x* <= 255

DESCRIPTION: LOOPTIME COMMAND
COMMANDCODE #31

Define the looptime used in the servo calculations for the furnace controller or get the current looptime from the furnace controller.

EXAMPLE:
```
F:LOOPTIME = 0
? F:LOOPTIME
0
```

NAME: **F:OVT.OVERRIDE**

SYNTAX: F:OVT.OVERRIDE = *0/1* or ? F:OVT.OVERRIDE

0 = don't override
1 = override

DESCRIPTION: OVERTEMP OVERRIDE COMMAND
COMMANDCODE #32

Override/don't override overtemp fault condition or return the last overtemp override setting. If an overtemp fault condition is overridden, it is important to clear the override after the fault condition is removed. If the override is not cleared, overtemp be detected.

EXAMPLE:
```
? F:OVT.OVERRIDE
1
F:OVT.OVERRIDE = 0
```

NAME: **F:OVEN.SELECT.STATUS**

SYNTAX: ? F:OVEN.SELECT.STATUS

DESCRIPTION: OVEN SELECT STATUS COMMAND
COMMANDCODE #33

Get the status from the furnace controller and return a status byte containing the select status for oven A and oven B:

0 = B Oven on
1 = A Oven on

EXAMPLE:
```
? F:SELECT.STATUS
0
```

NAME: **F:CONTROL.START.STATUS**

SYNTAX: ? F:CONTROL.START.STATUS

DESCRIPTION: CONTROL START STATUS COMMAND
COMMANDCODE #34

Get the status from the furnace controller and return a status byte containing the control start status:

0 = Control start is disabled
1 = Control start is enabled

EXAMPLE: ? F:CONTROL.START.STATUS
0

NAME: **F:FURNACE.STATUS**

SYNTAX: ? F:FURNACE.STATUS

DESCRIPTION: FURNACE CONTROLLER STATUS COMMAND
COMMANDCODE #35

Get the status from the furnace controller and return a bitmapped status byte:

Bit 0 Invalid command ID or invalid byte count
Bit 1 28 volt bus too low to achieve command setpoint
Bit 2 Overtemp occurred
Bit 3 Invalid checksum
Bit 4 Last power or temperature setpoint out of range
Bit 5 Watchdog activated
Bit 6 Not used
Bit 7 Not used

EXAMPLE: ? F:FURNACE.STATUS
0

NAME: **F:COMM.STATUS**

SYNTAX: ? F:COMM.STATUS

DESCRIPTION: COMMUNICATION STATUS COMMAND
COMMANDCODE #36

Return a bitmapped status byte containing the communication status of the last furnace command:

Bit 0 Not used
Bit 1 Not used
Bit 2 Not used
Bit 3 Not used
Bit 4 Invalid checksum
Bit 5 Invalid command code
Bit 6 Invalid byte count
Bit 7 Interbyte timeout

EXAMPLE: ? F:COMM.STATUS
0

NAME: **F:MODULE.STATUS**

SYNTAX: ? F:MODULE.STATUS

DESCRIPTION: FURNACE MODULE STATUS COMMAND
COMMANDCODE #37

Return the status of the last EasyLab command:

1 = Hard abort
2 = User stop
3 = Furnace Controller communication error
4 = Furnace fault
9 = Furnace module cannot sign on
10 = Furnace version is not available
11 = Invalid furnace command
12 = Command is not for this furnace
13 = Memory request denied (insufficient memory)
14 = Dictionary entry does not exist
15 = Dictionary entry already exists
16 = Illegal furnace index

EXAMPLE: ? F:MODULE.STATUS
0

NAME: **F:ERROR.DESCRIPTION**

SYNTAX: ? F:ERROR.DESCRIPTION

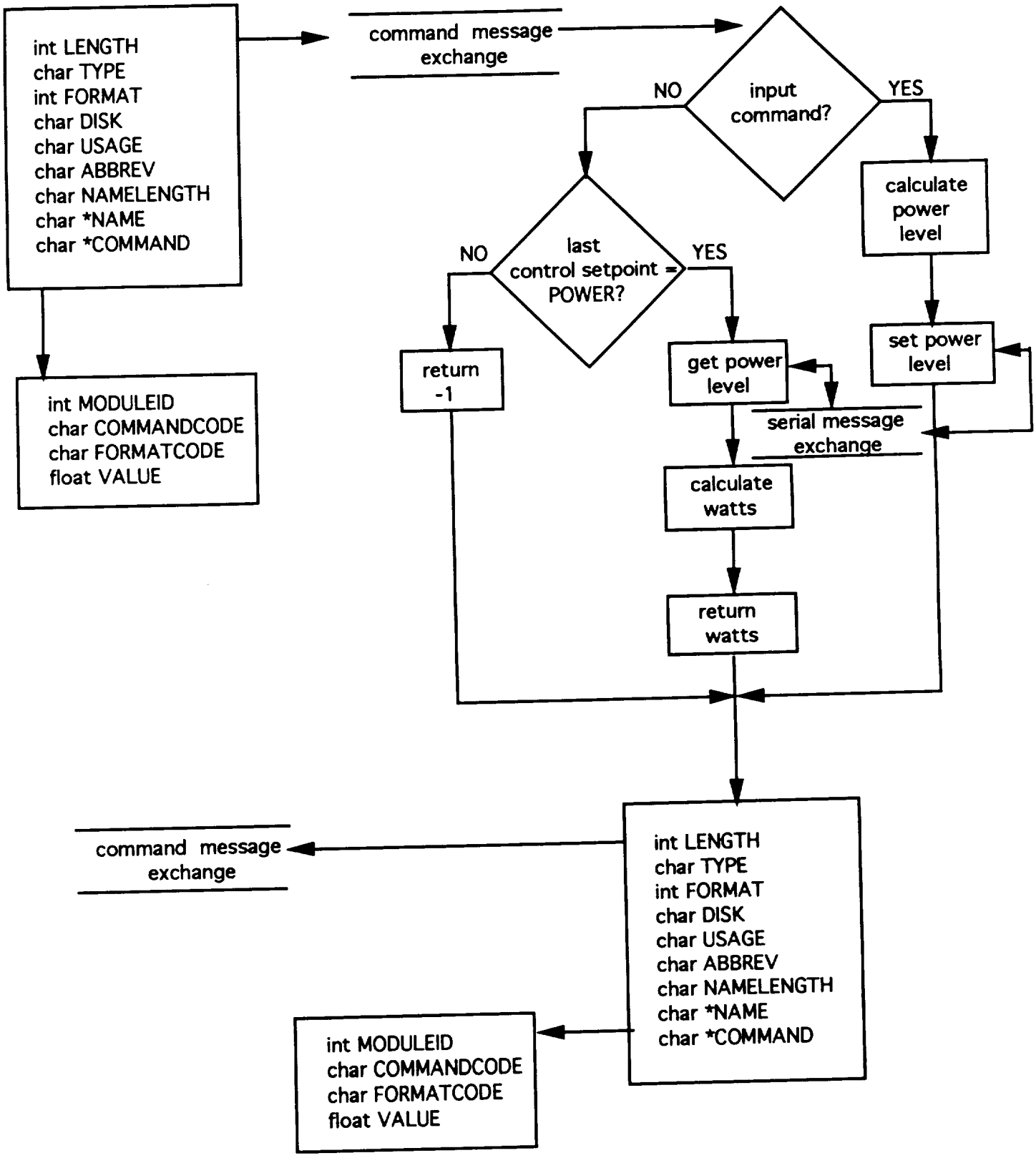
DESCRIPTION: ERROR DESCRIPTION COMMAND
COMMANDCODE #38

Return a description of the last error.

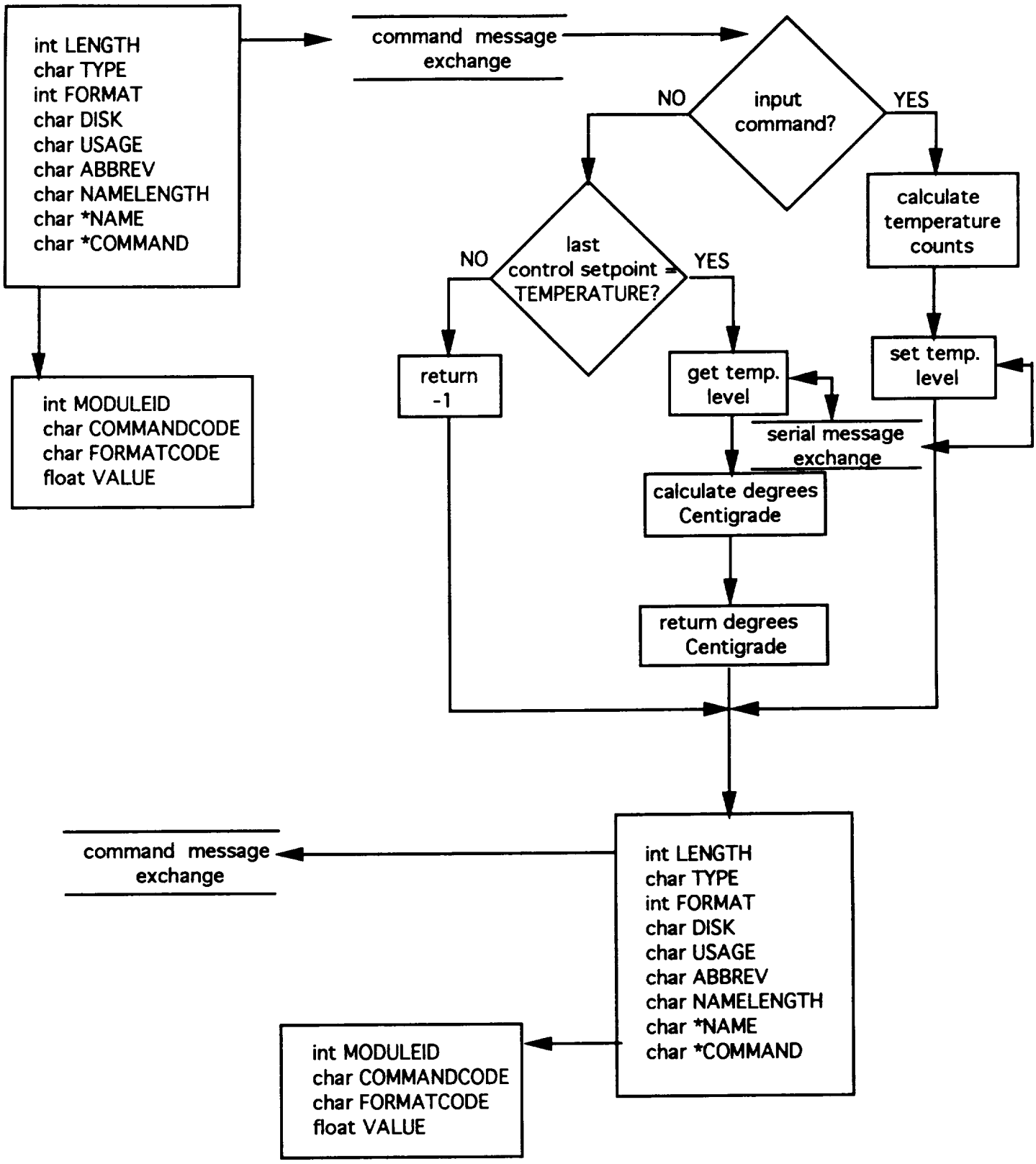
EXAMPLE: ? F:ERROR.DESCRIPTION
FURNACE/CONTROLLER COMMUNICATION ERROR

FURNACE
EASYLAB COMMANDS
FLOW CHARTS

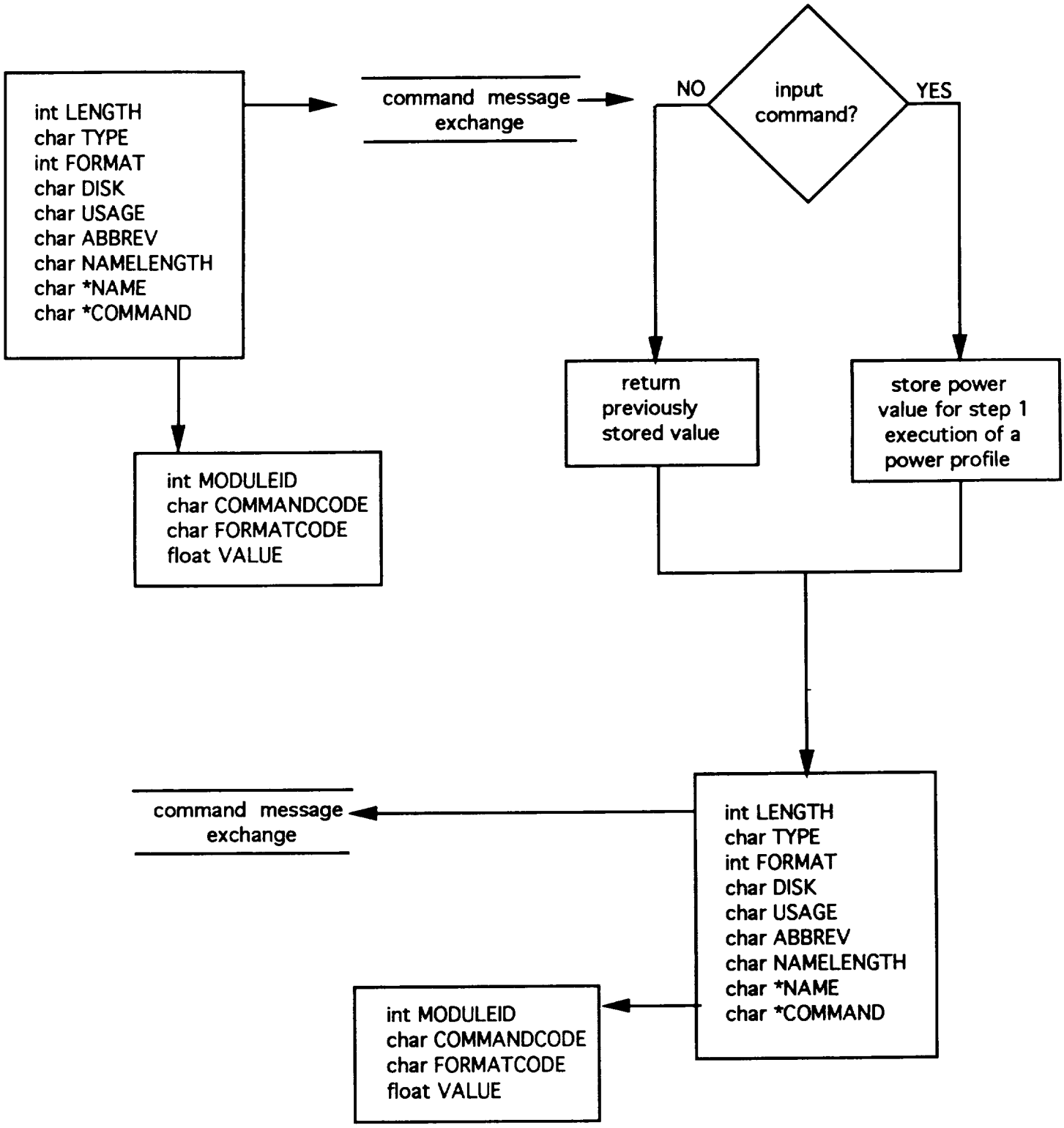
SET POWER LEVEL
COMMANDCODE #1



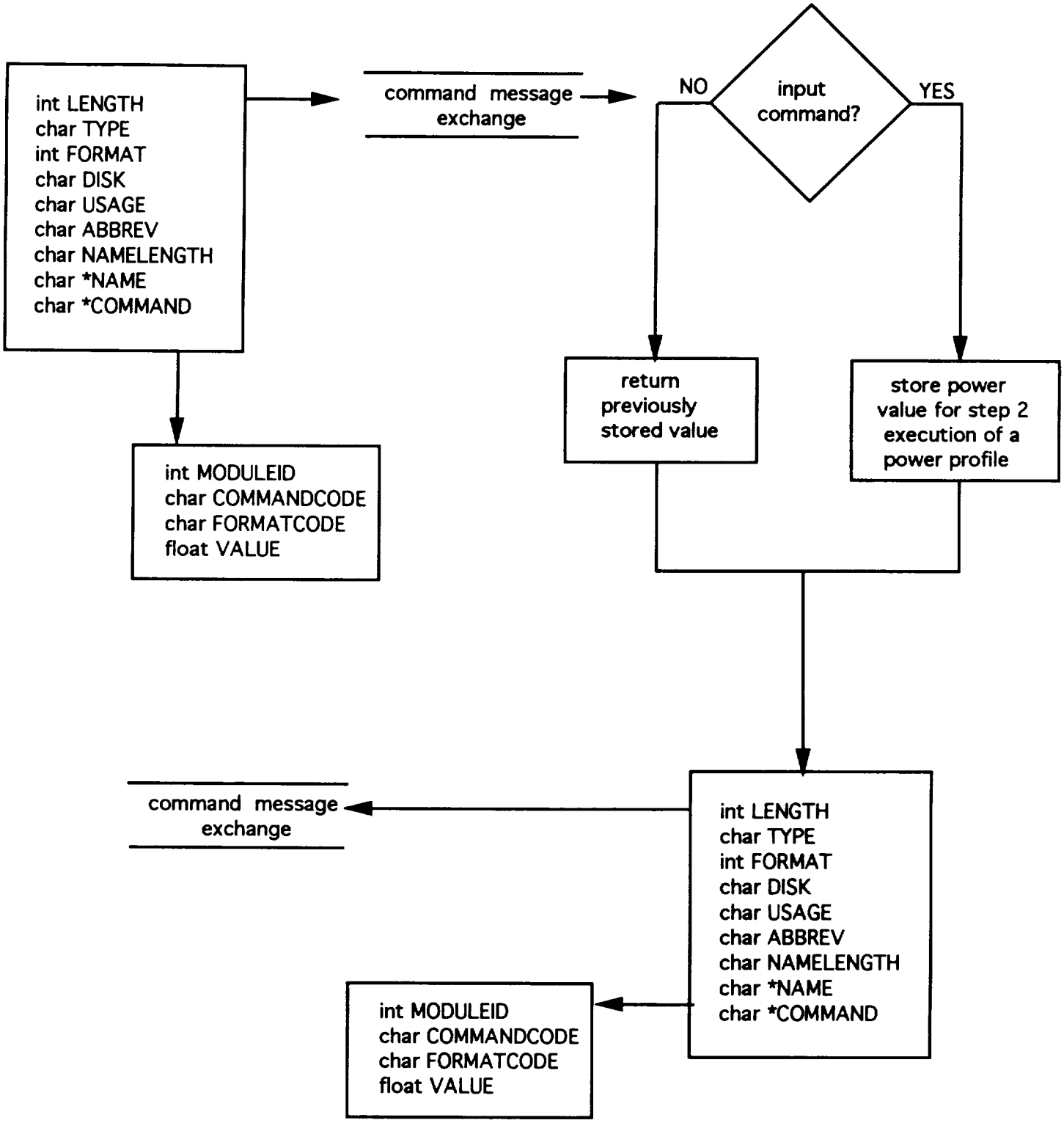
SET TEMPERATURE
COMMANDCODE #2



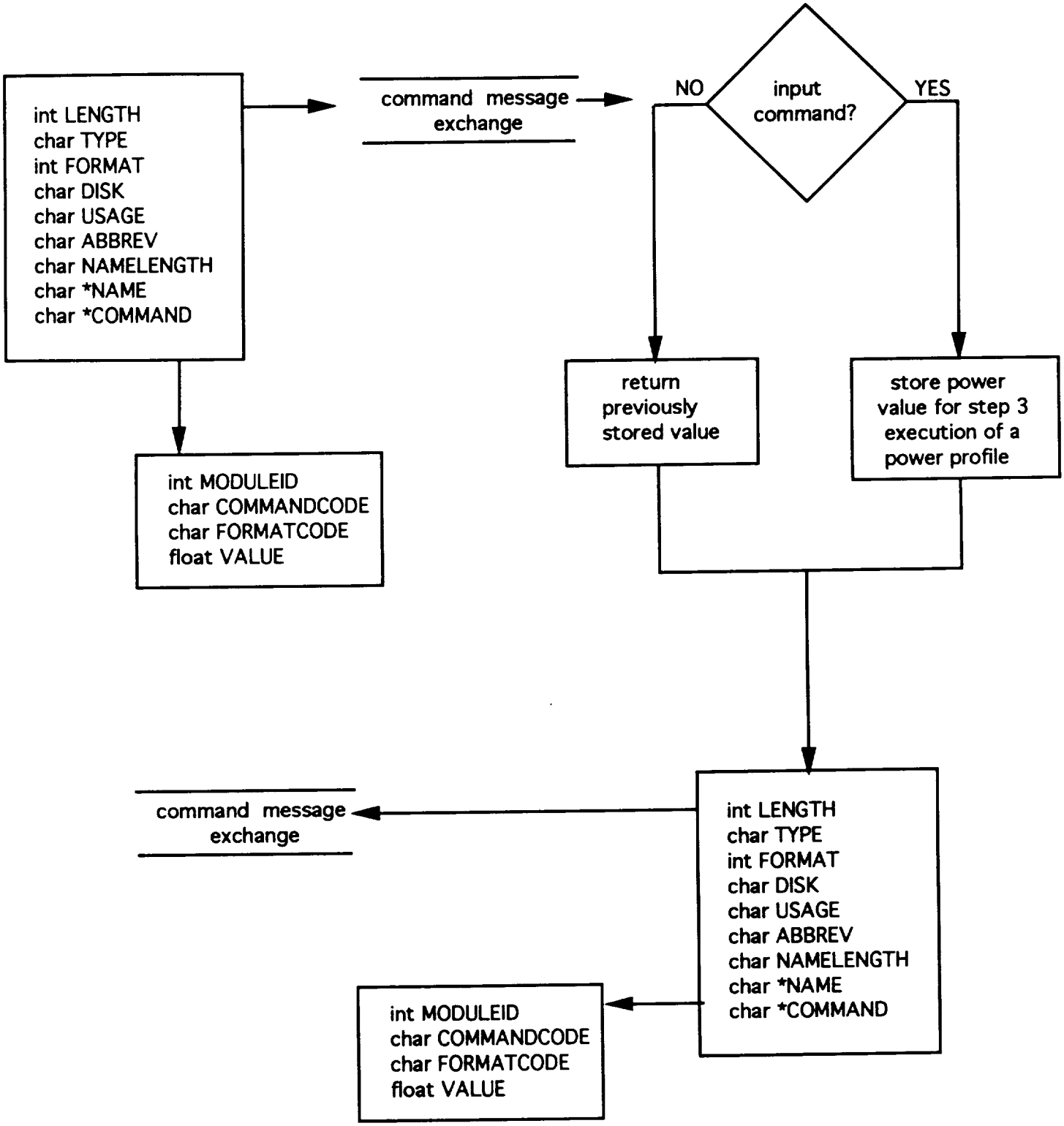
SET POWER PROFILE STEP 1
COMMANDCODE #3



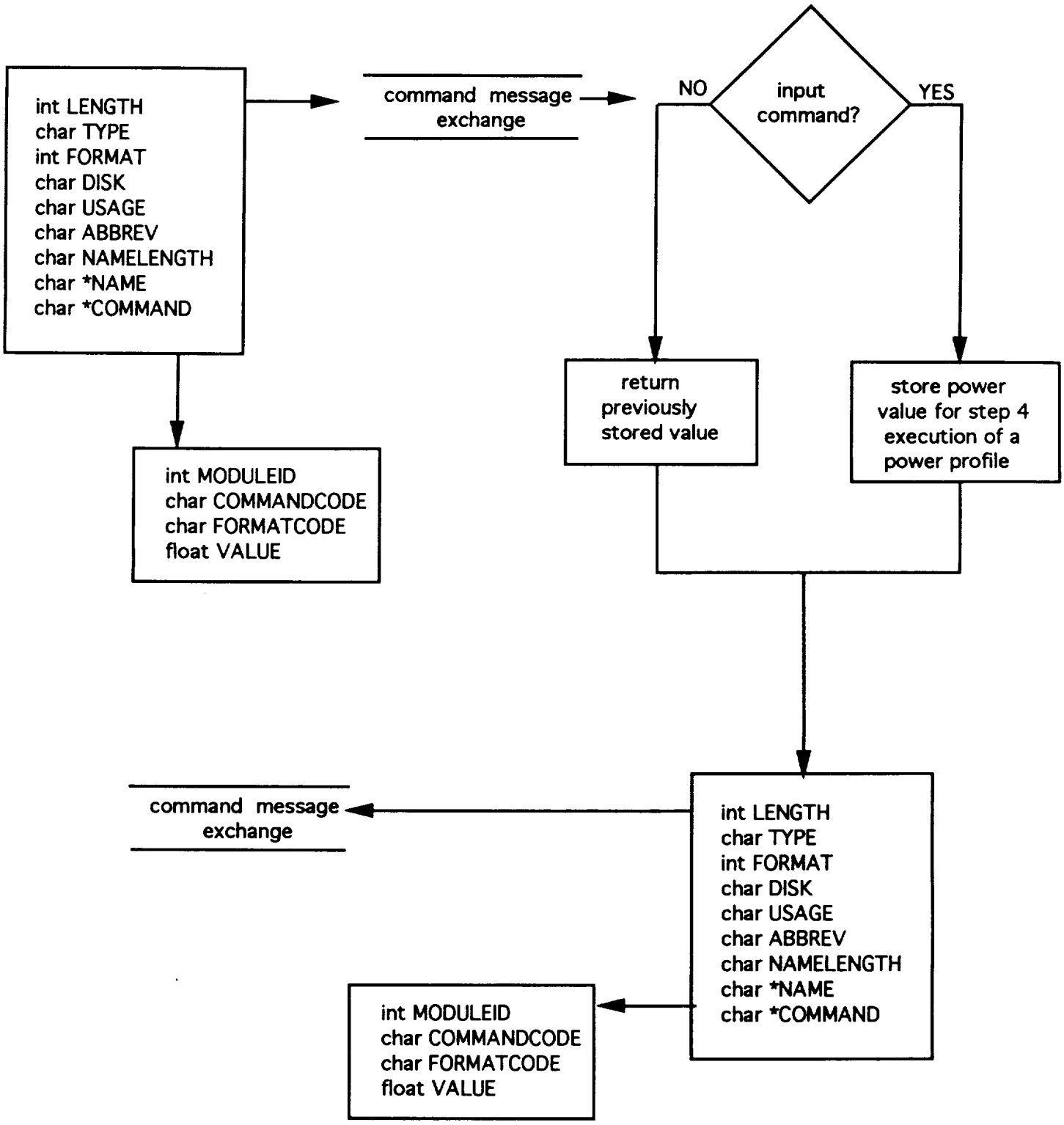
SET POWER PROFILE STEP 2
COMMANDCODE #4



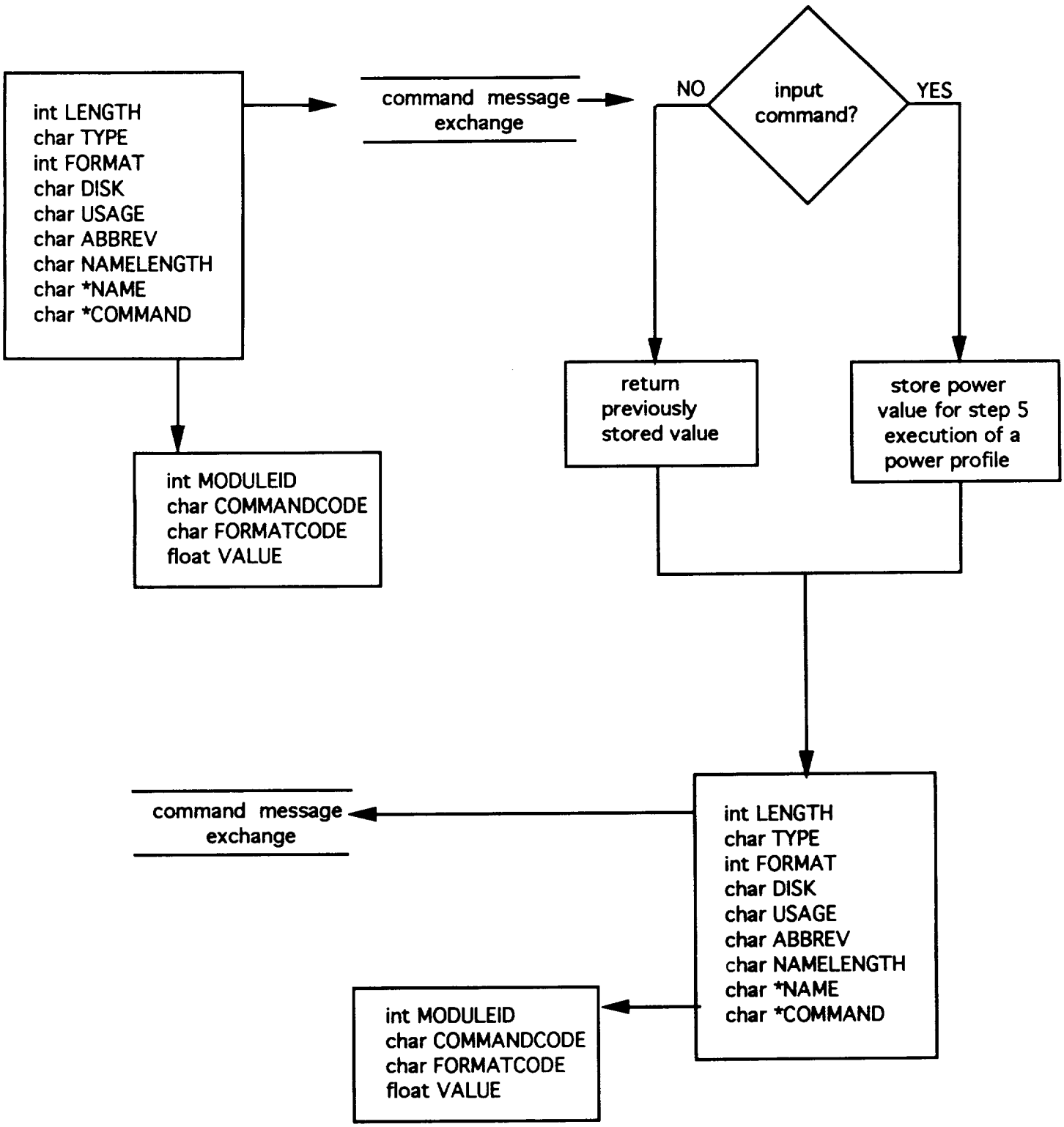
SET POWER PROFILE STEP 3
COMMANDCODE #5



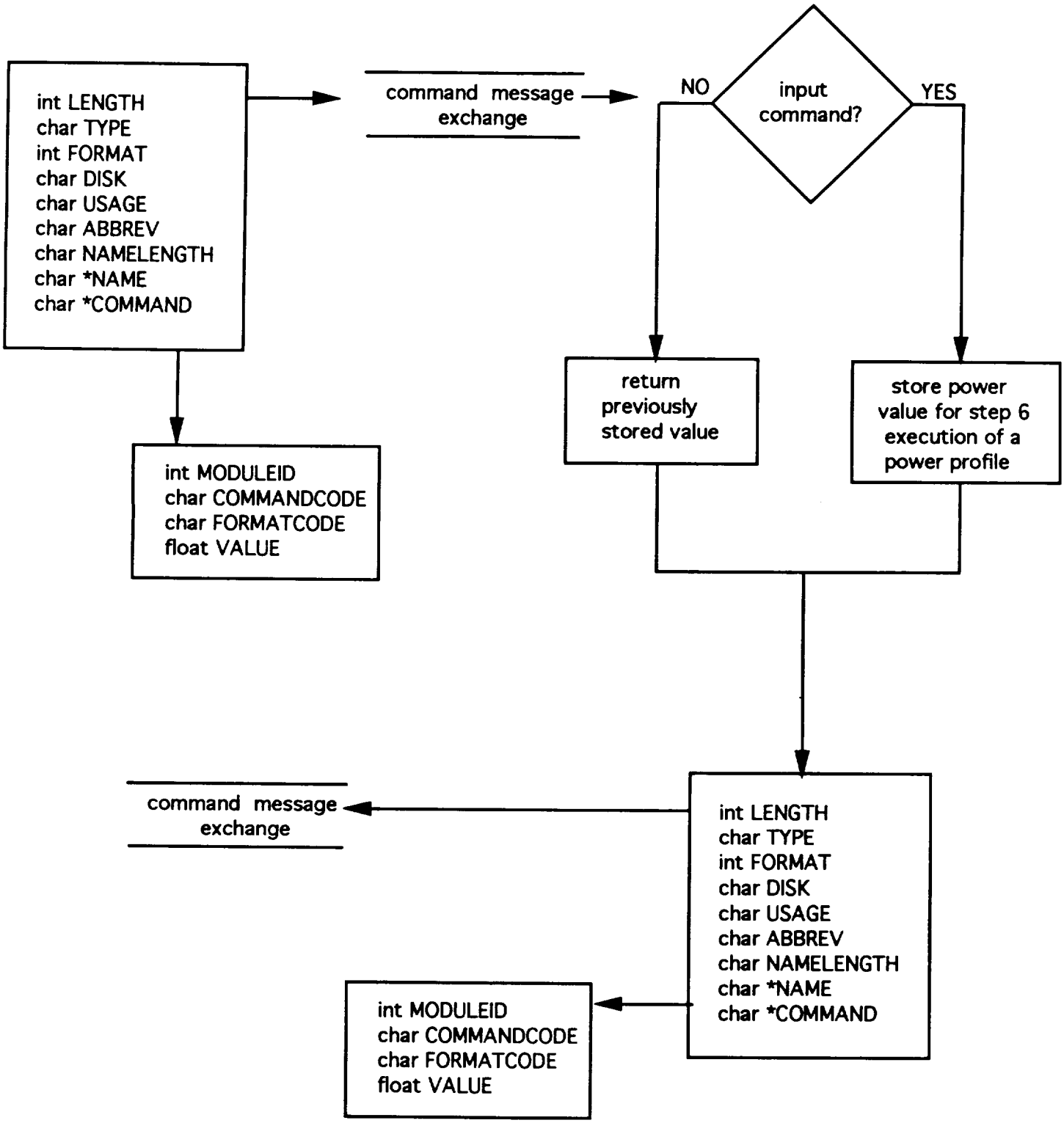
SET POWER PROFILE STEP 4
COMMANDCODE #6



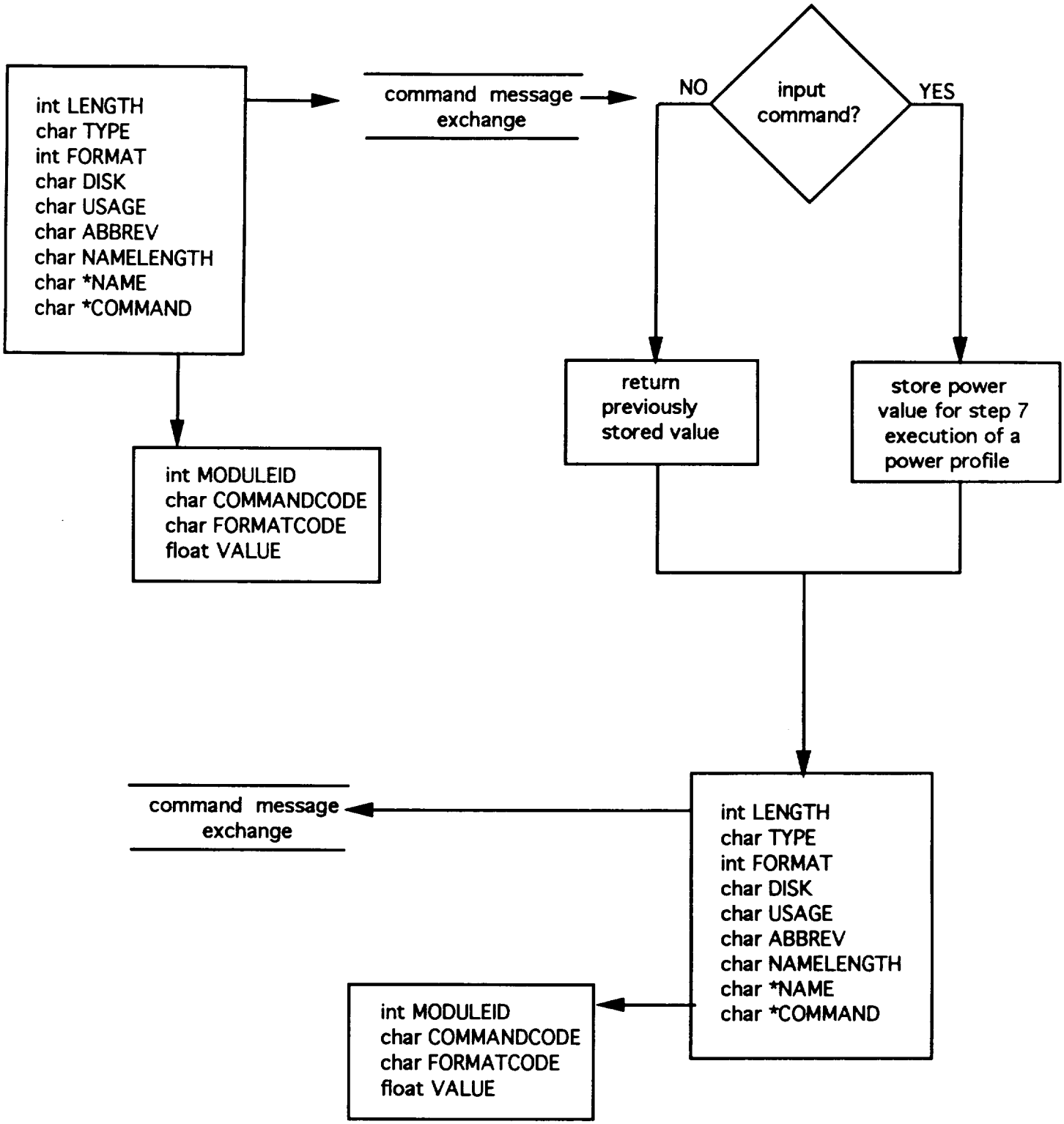
SET POWER PROFILE STEP 5
COMMANDCODE #7



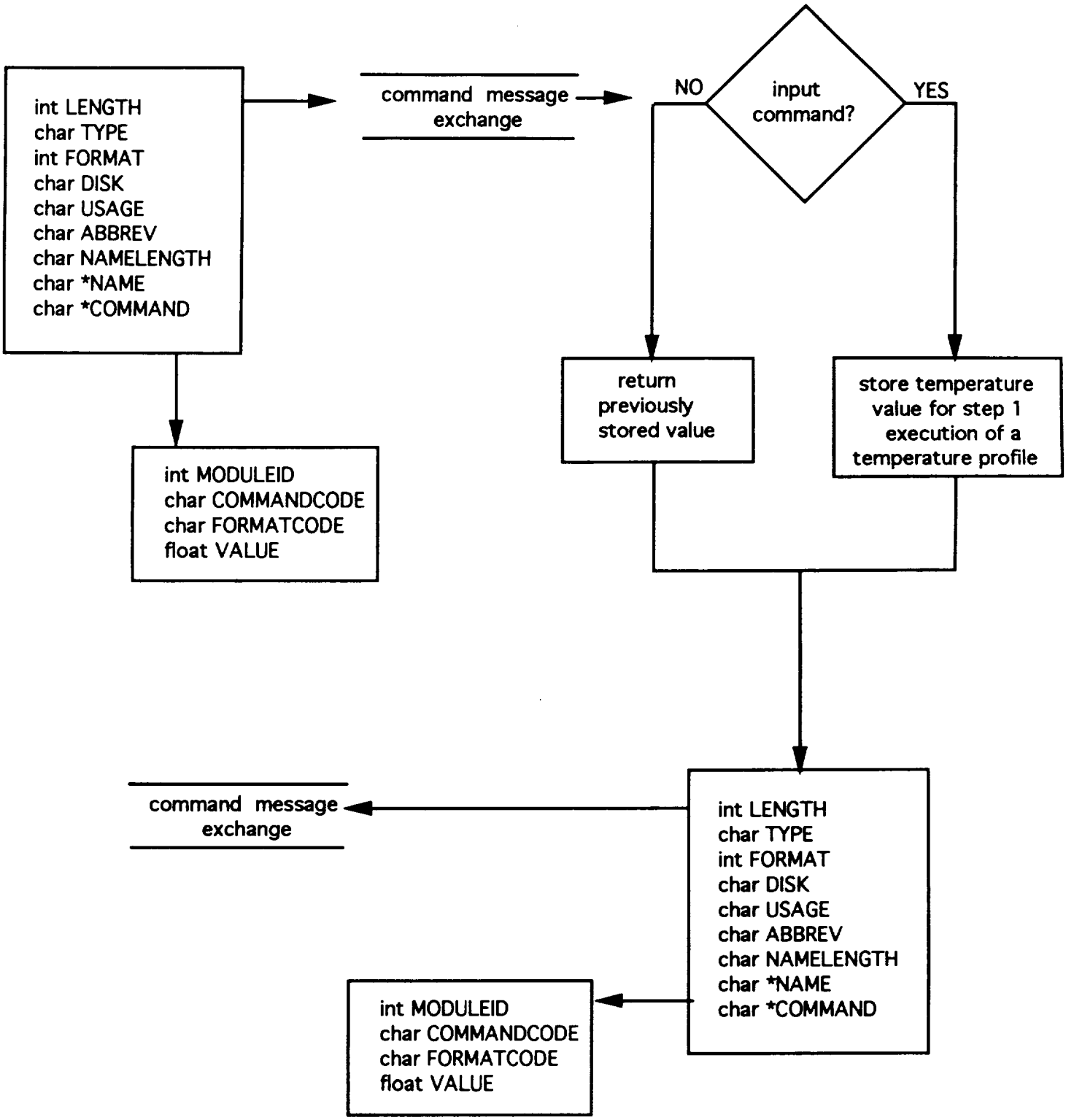
SET POWER PROFILE STEP 6
COMMANDCODE #8



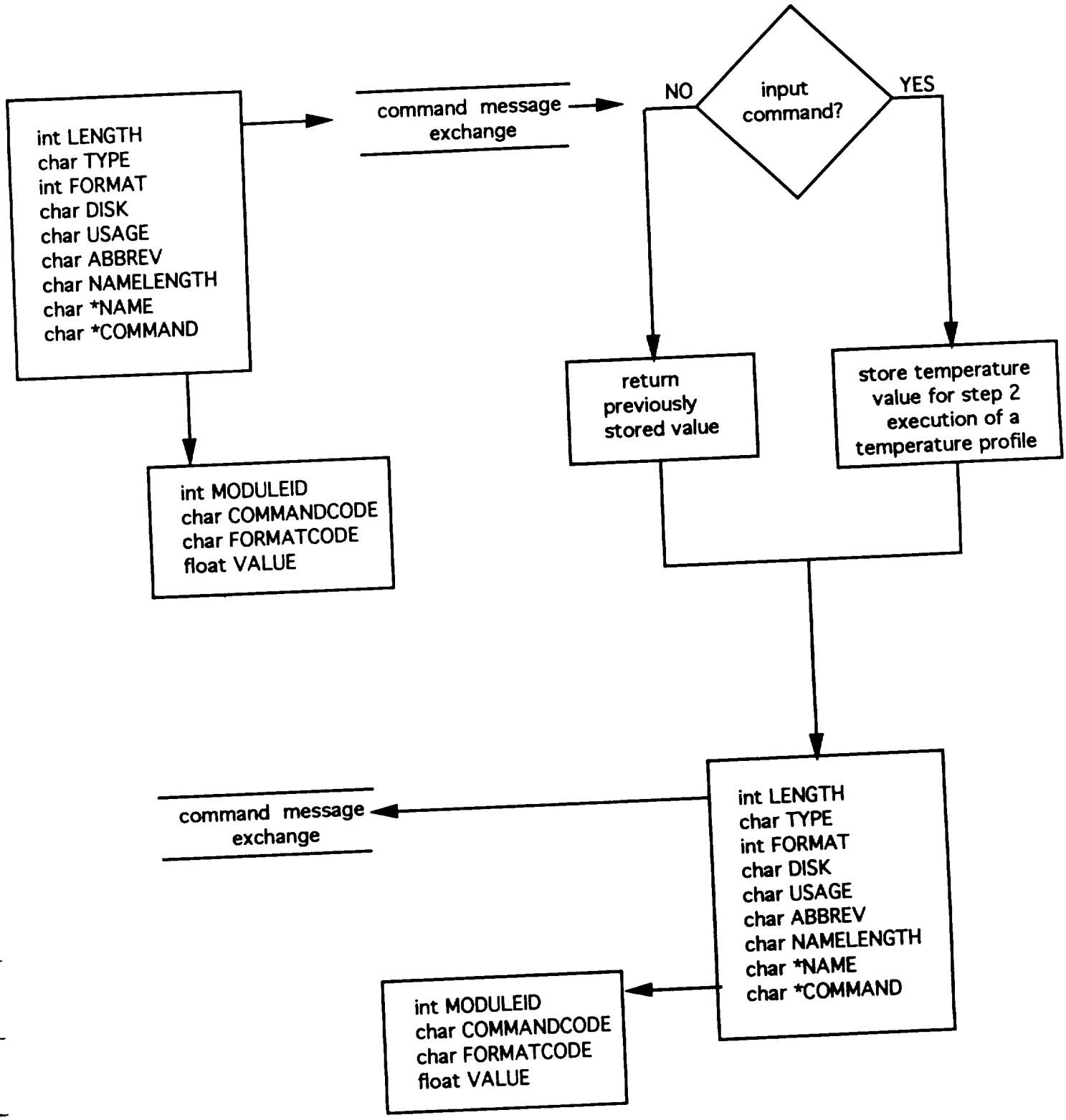
SET POWER PROFILE STEP 7
COMMANDCODE #9



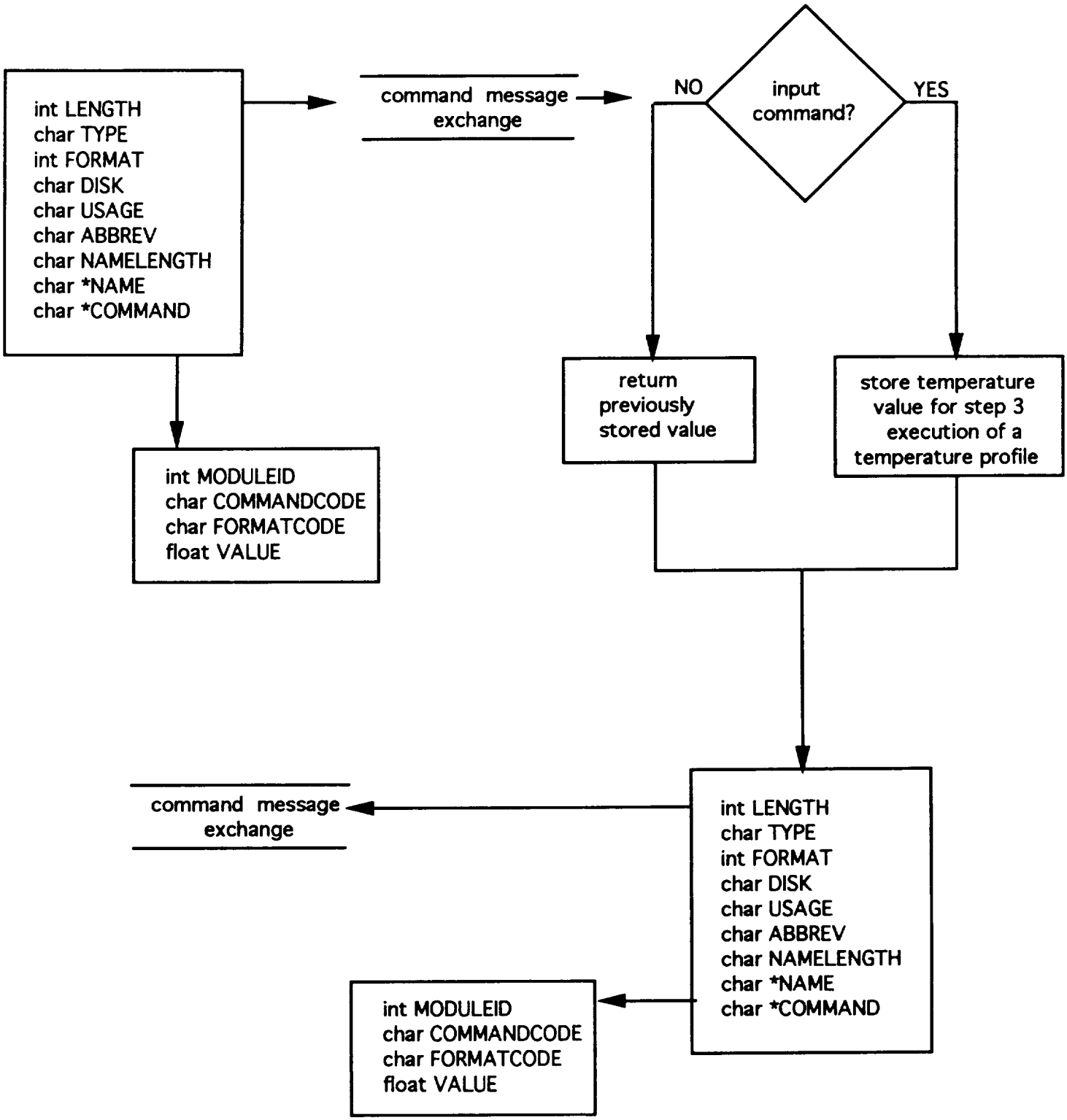
SET TEMPERATURE PROFILE STEP 1
COMMANDCODE #10



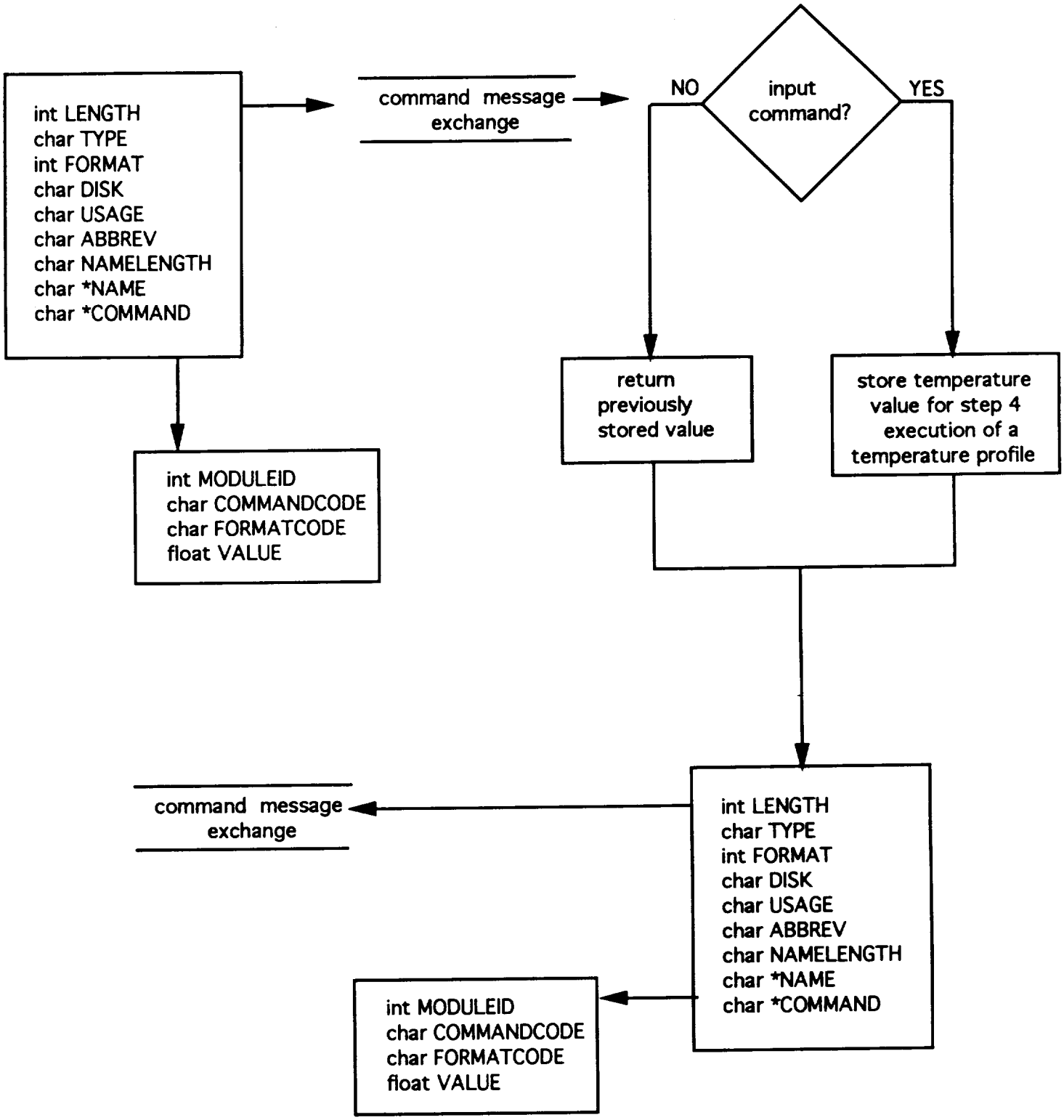
SET TEMPERATURE PROFILE STEP 2
COMMANDCODE #11



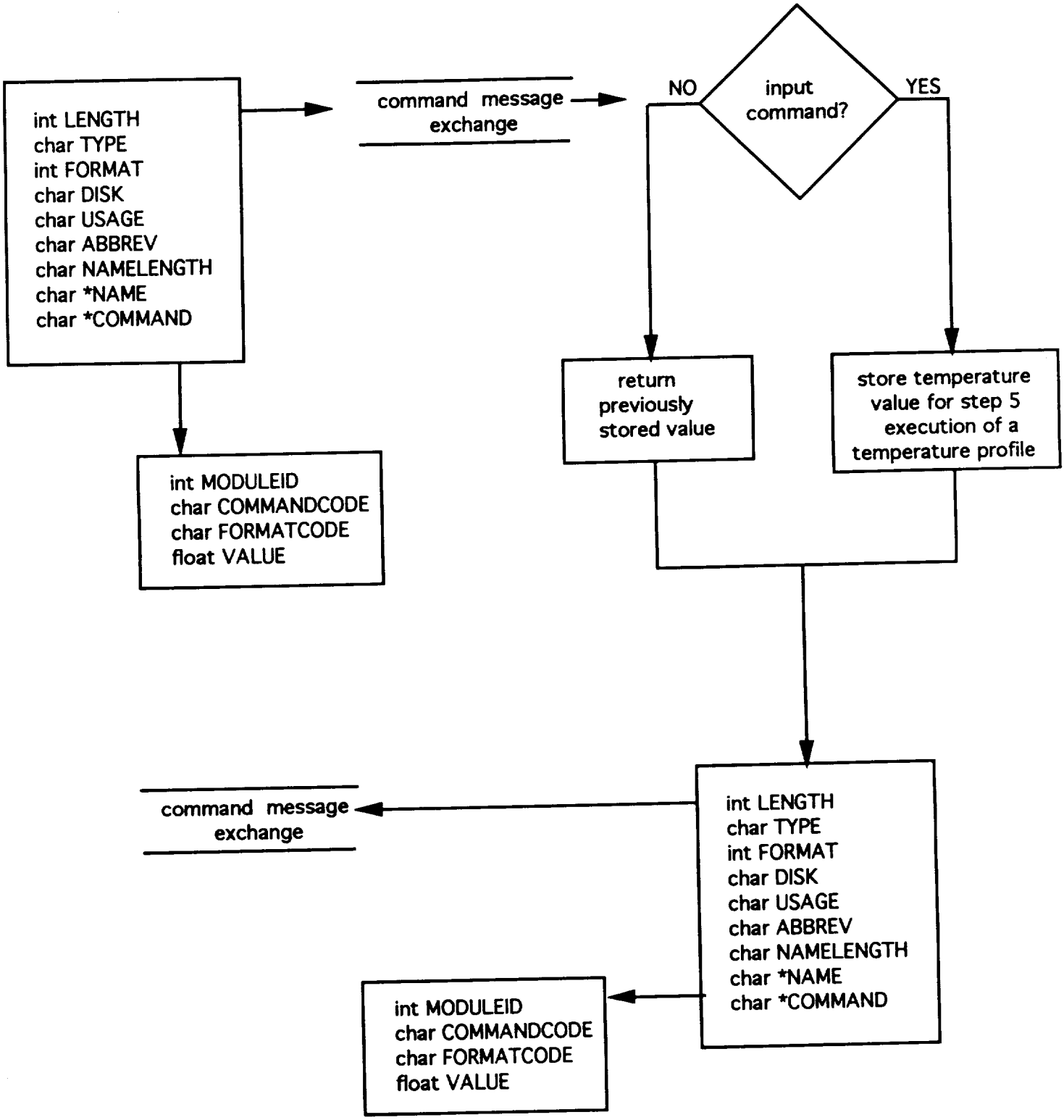
SET TEMPERATURE PROFILE STEP 3
COMMANDCODE #12



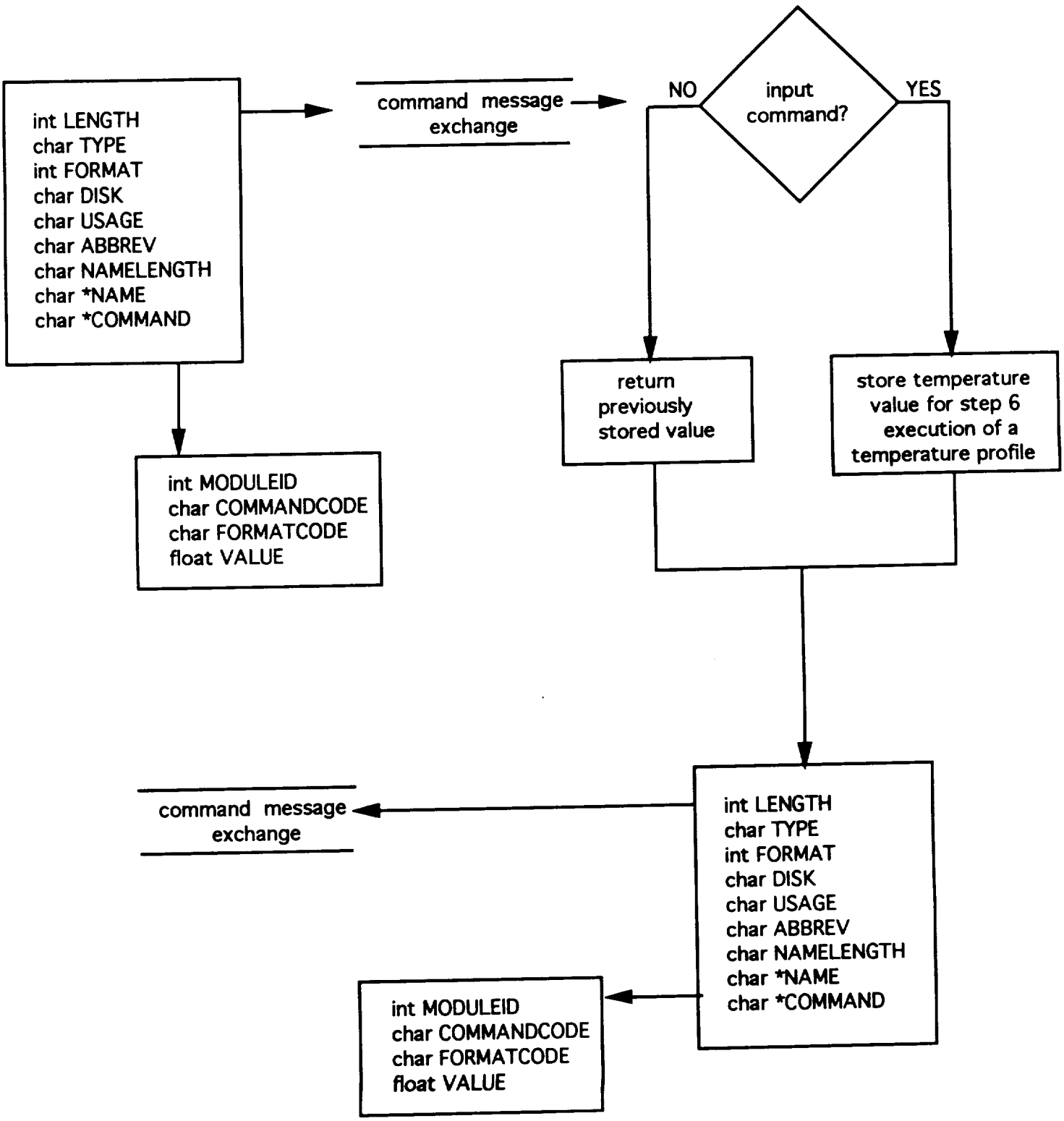
SET TEMPERATURE PROFILE STEP 4
COMMANDCODE #13



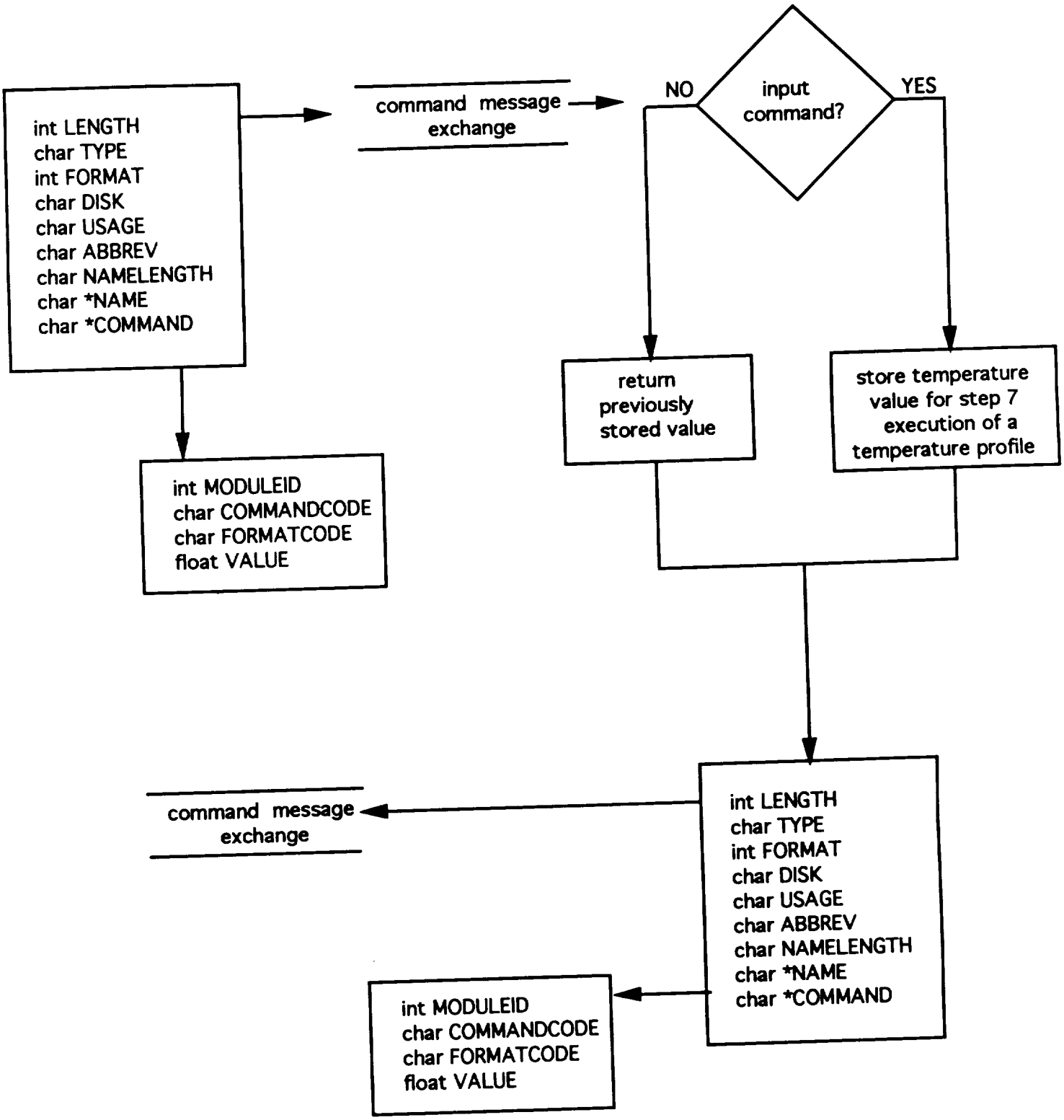
SET TEMPERATURE PROFILE STEP 5
COMMANDCODE #14



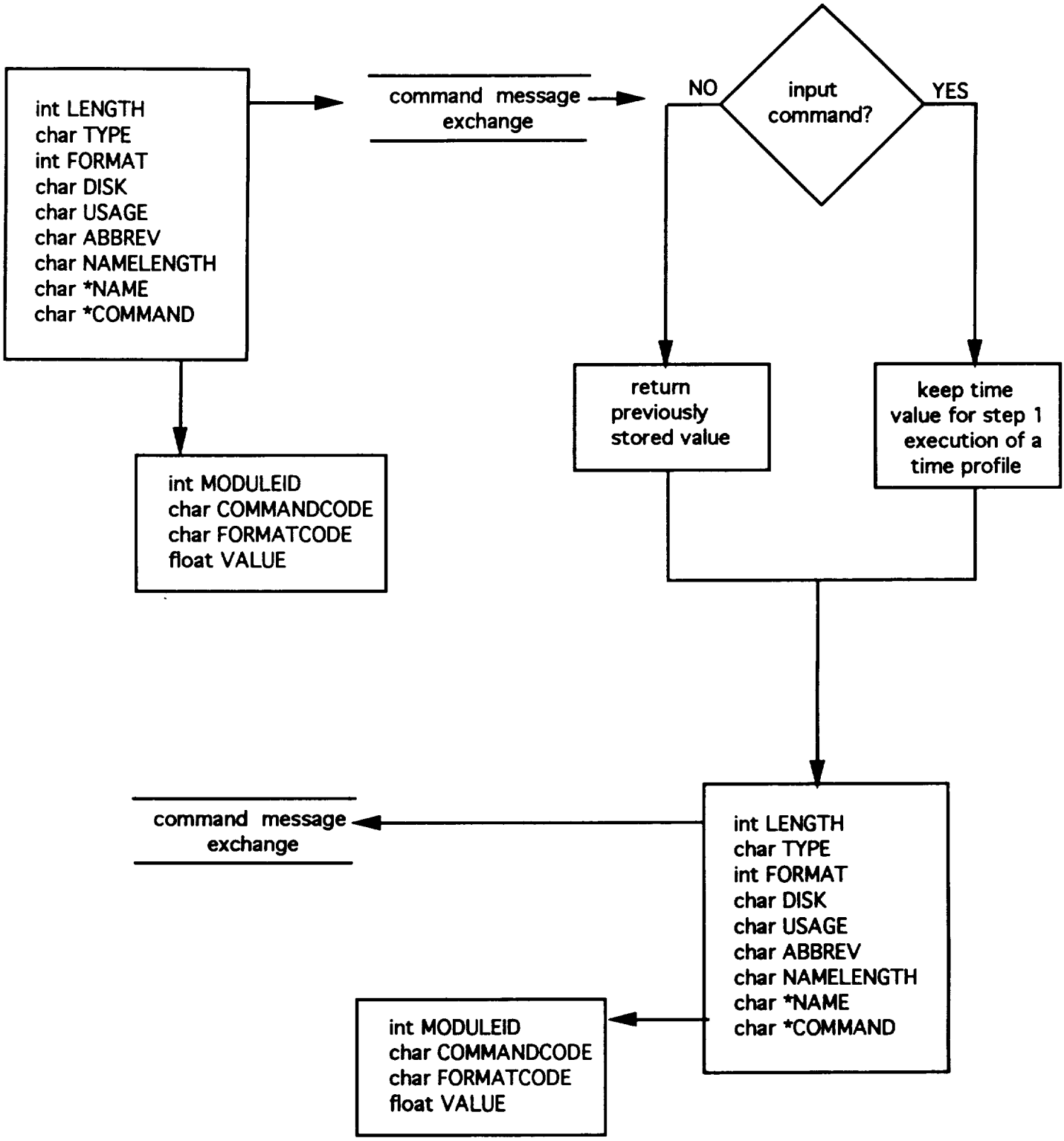
SET TEMPERATURE PROFILE STEP 6
COMMANDCODE #15



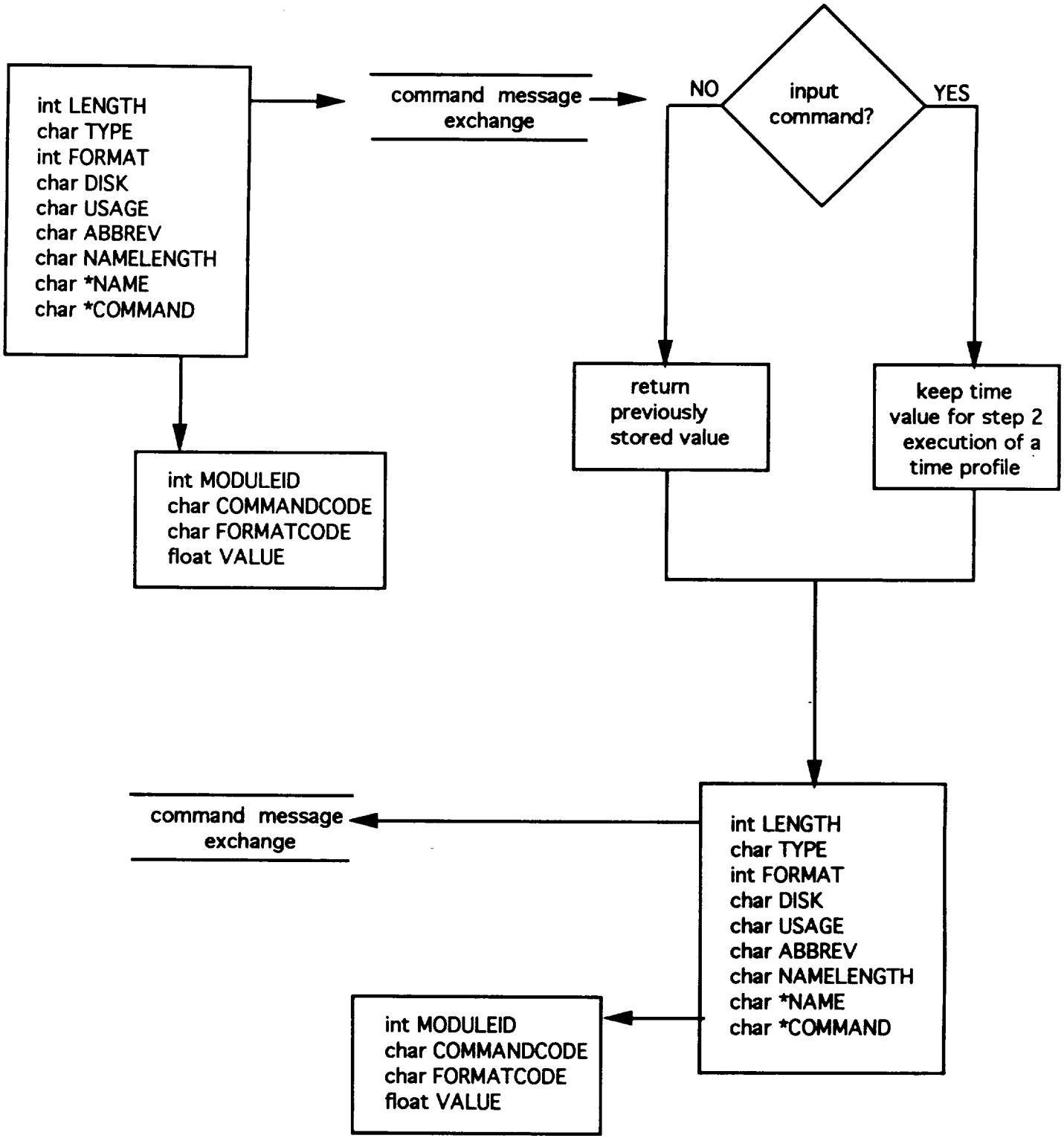
SET TEMPERATURE PROFILE STEP 7
COMMANDCODE #16



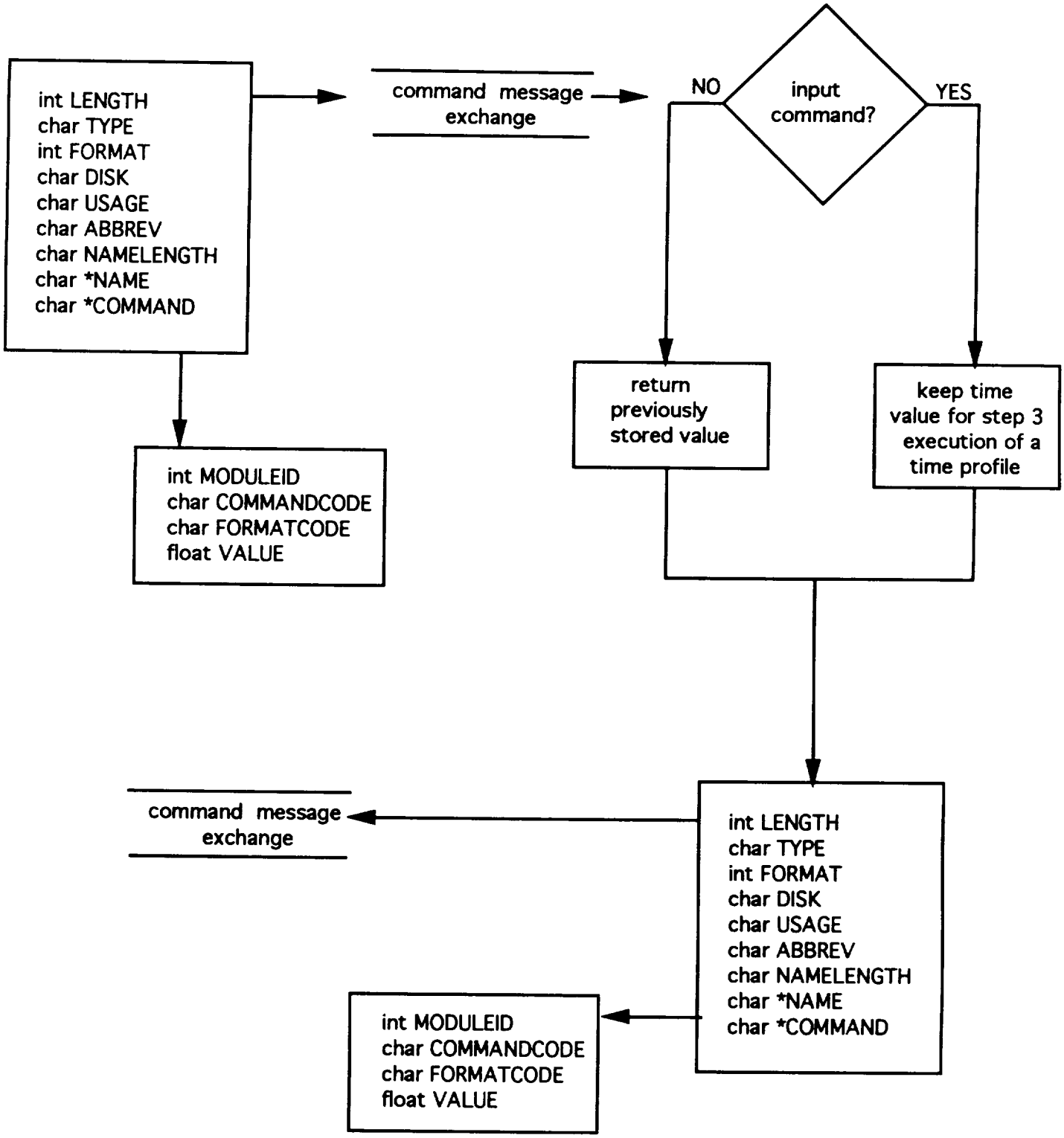
SET TIME PROFILE STEP 1
COMMANDCODE #17



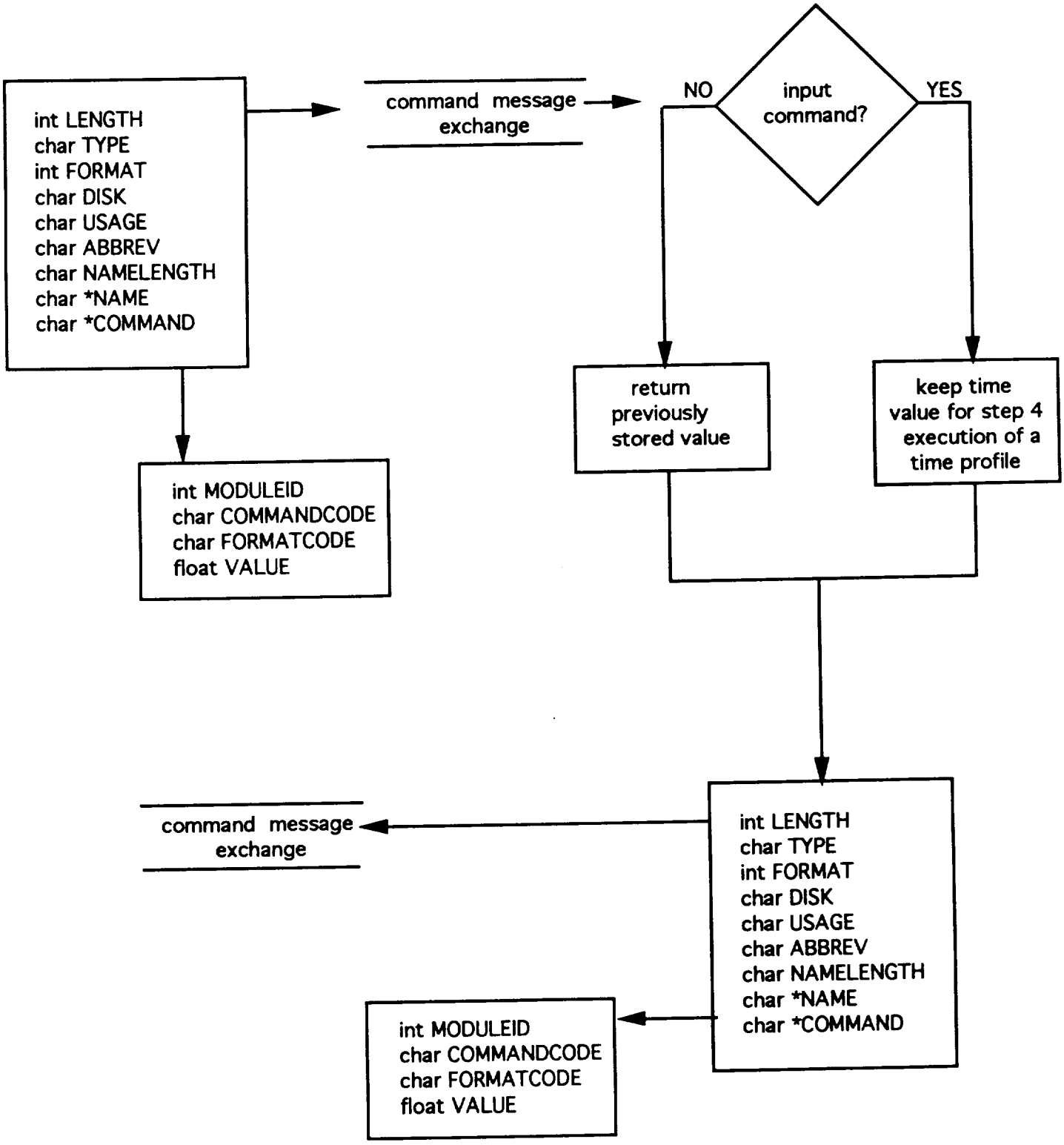
SET TIME PROFILE STEP 2
COMMANDCODE #18



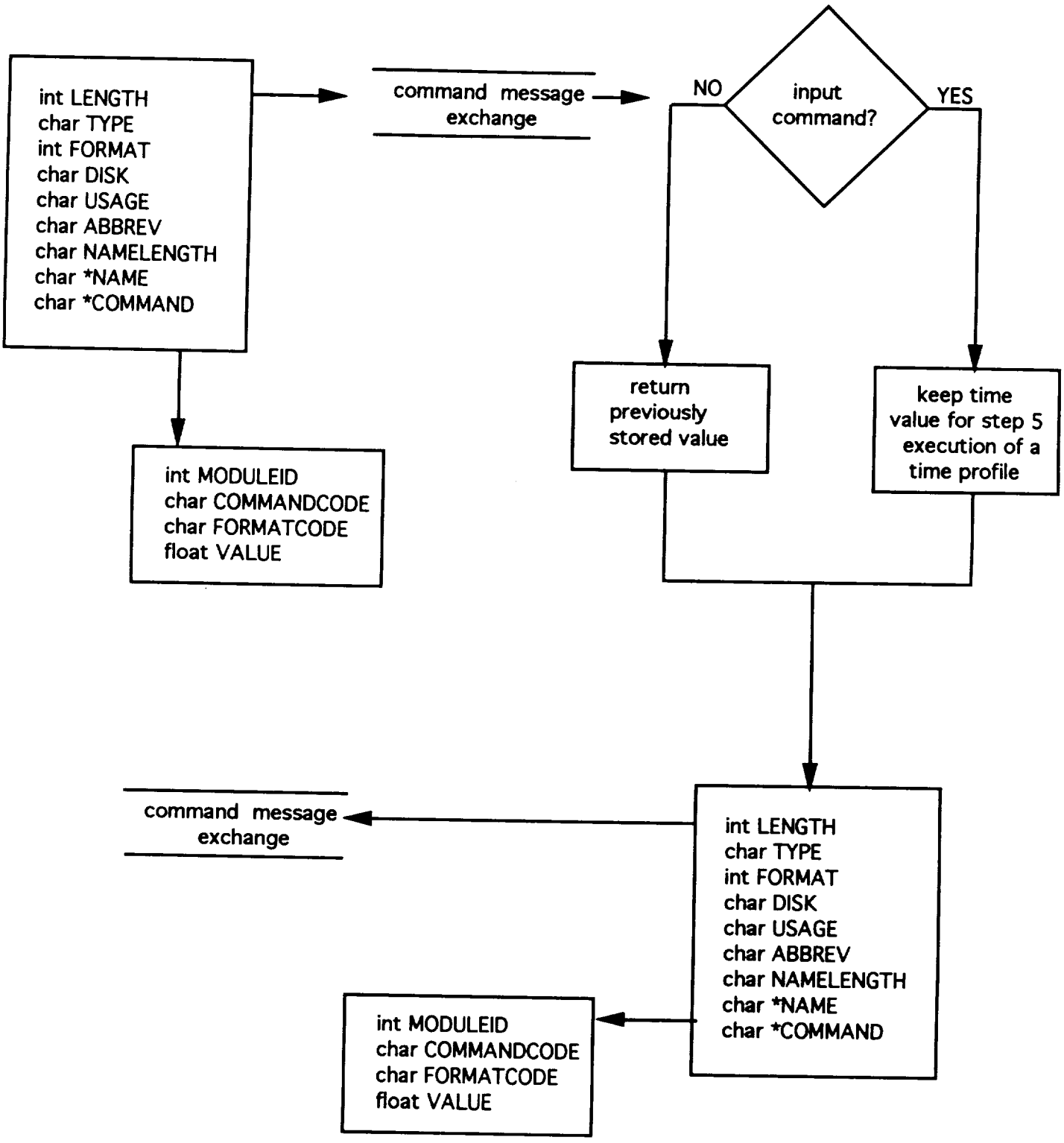
SET TIME PROFILE STEP 3
COMMANDCODE #19



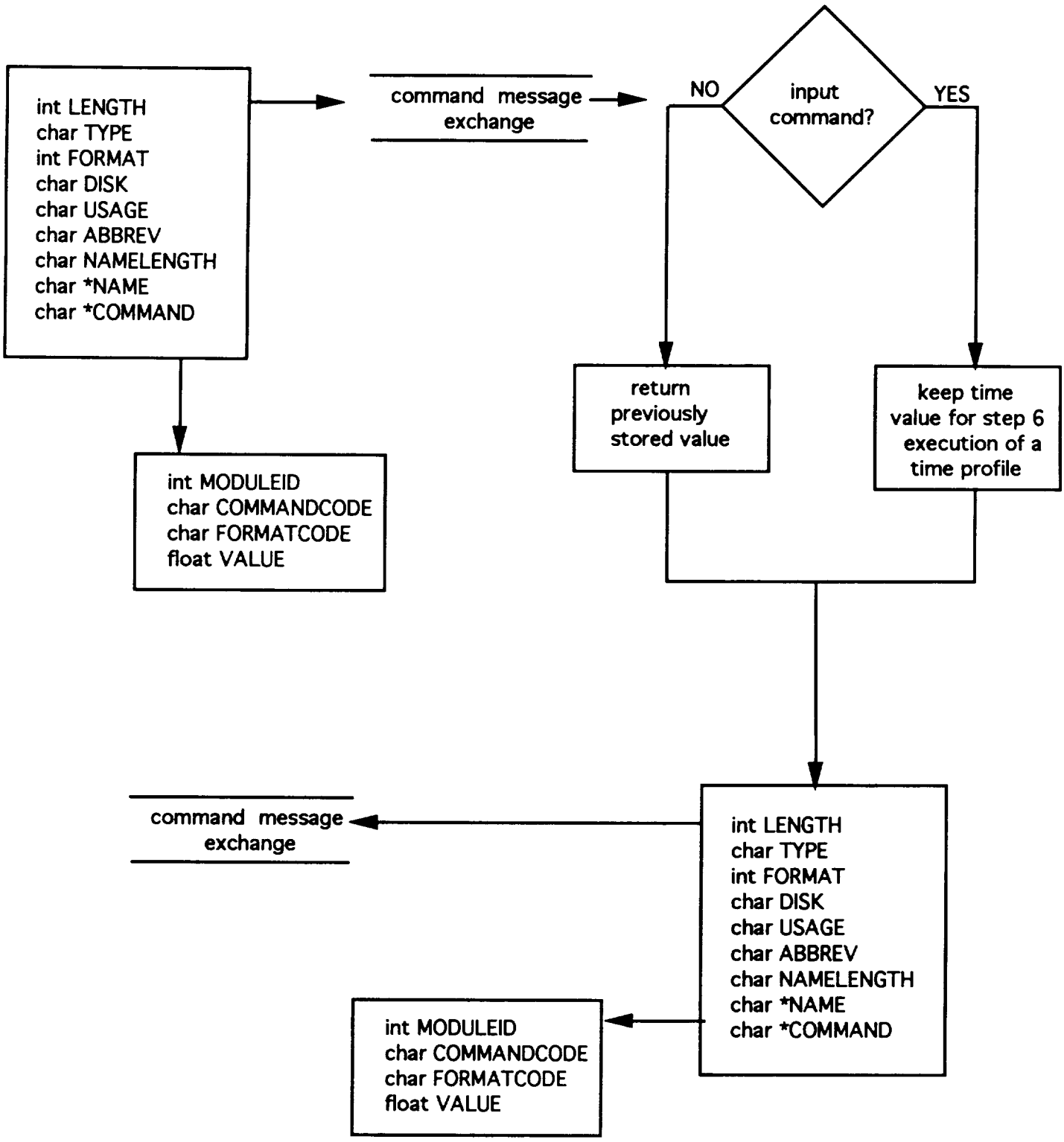
SET TIME PROFILE STEP 4
COMMANDCODE #20



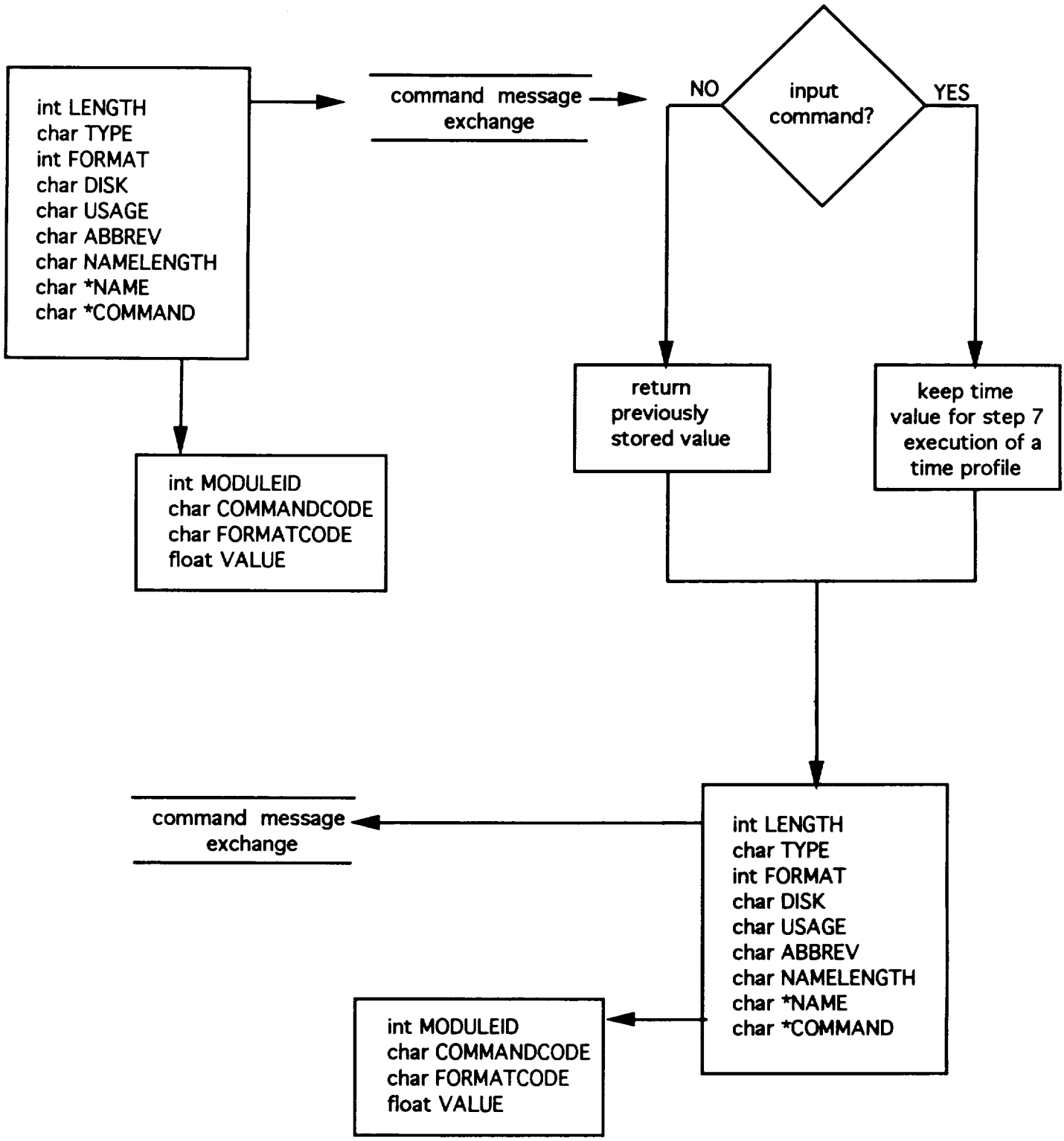
SET TIME PROFILE STEP 5
COMMANDCODE #21



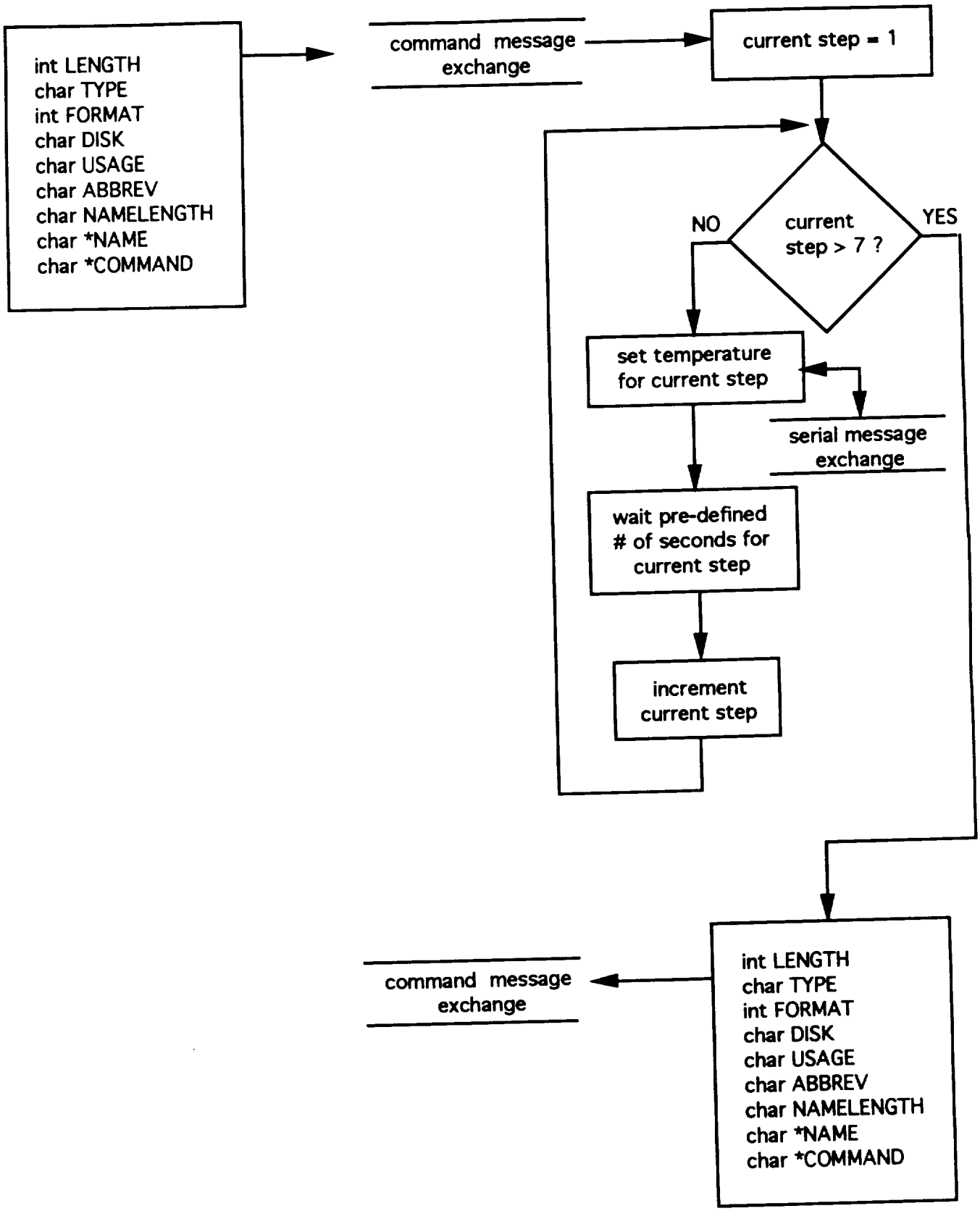
SET TIME PROFILE STEP 6
COMMANDCODE #22



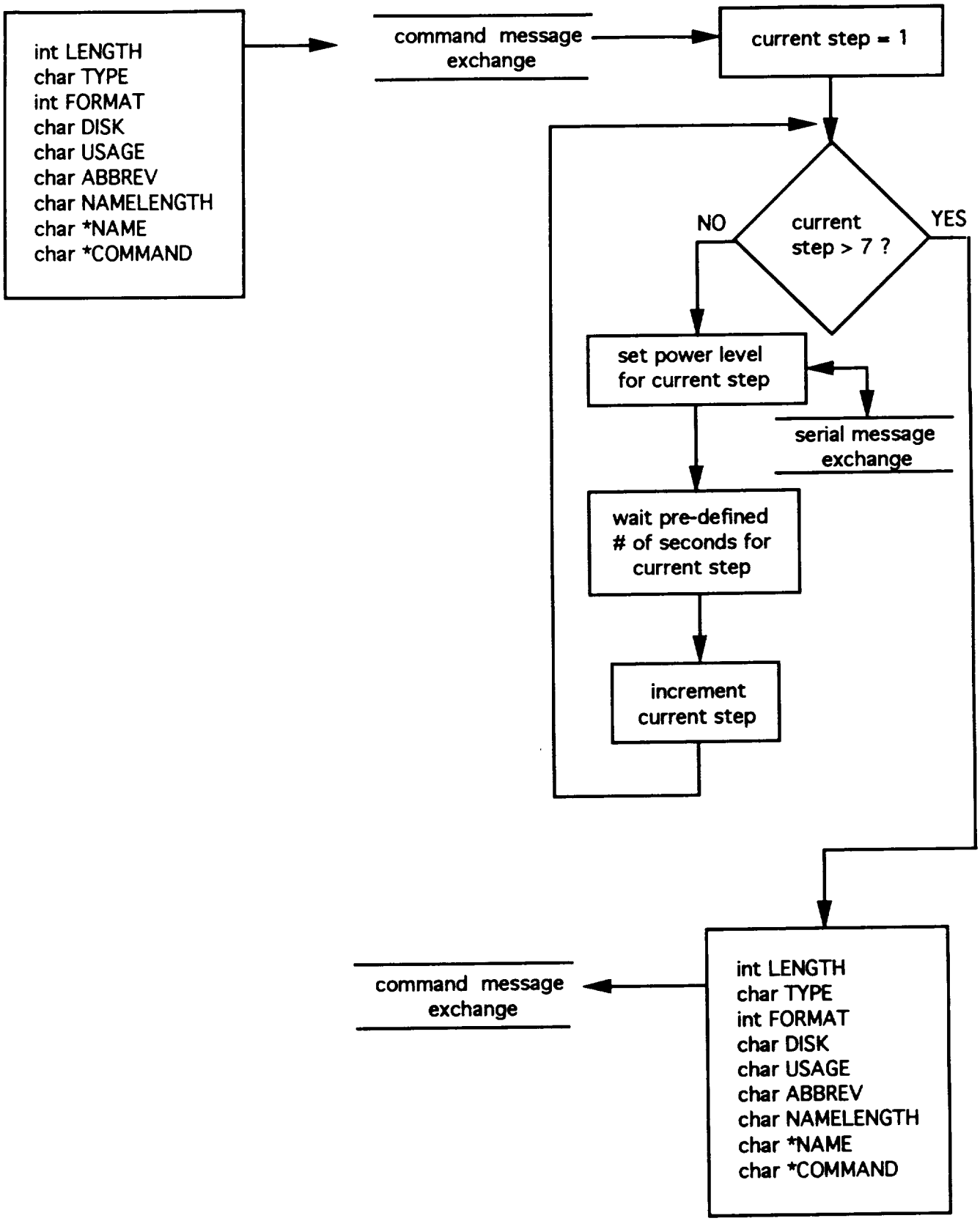
SET TIME PROFILE STEP 7
COMMANDCODE #23



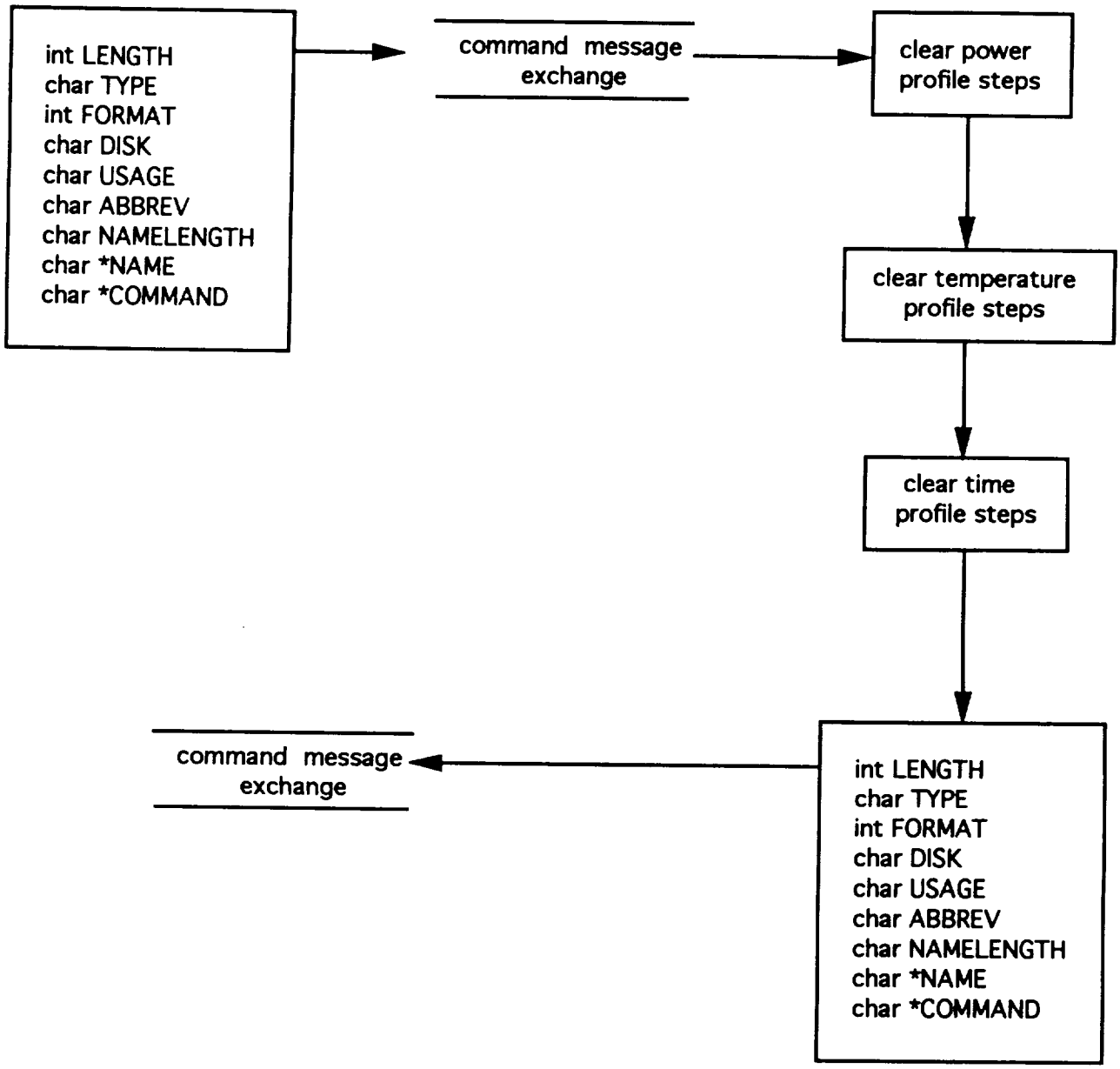
EXECUTE TEMPERATURE PROFILE
COMMANDCODE #24



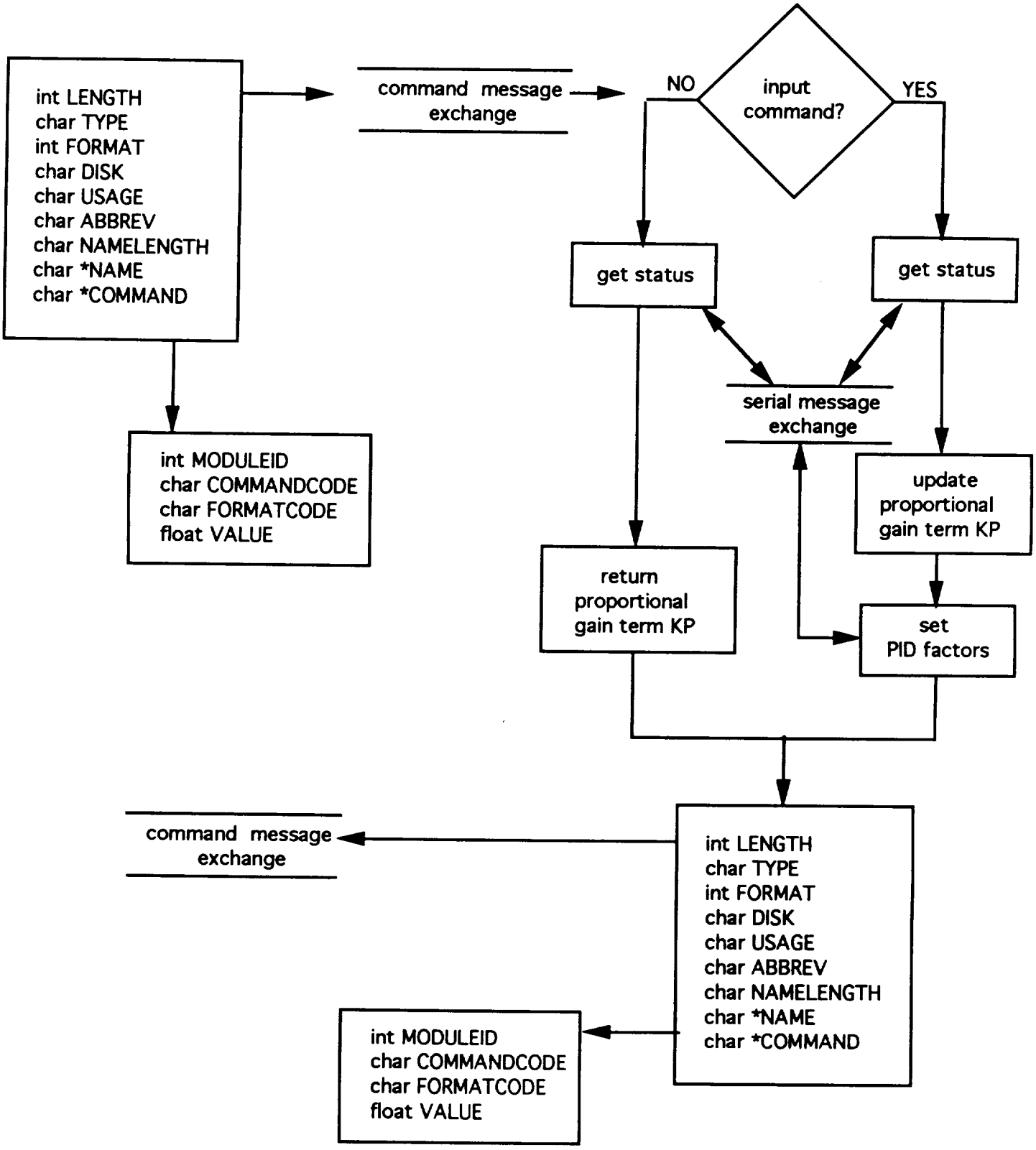
EXECUTE POWER PROFILE
COMMANDCODE #25



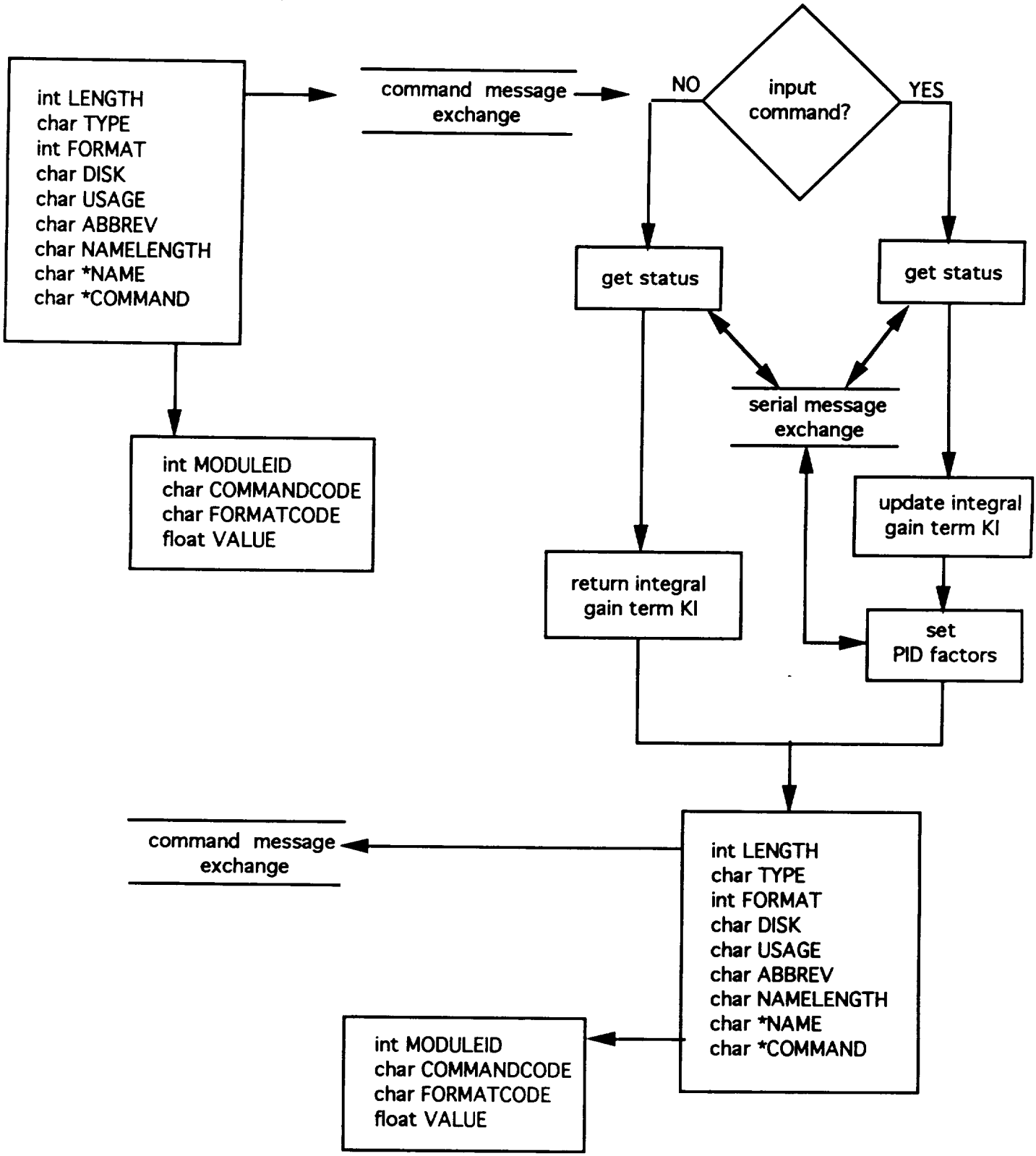
CLEAR PROFILES
COMMANDCODE #26



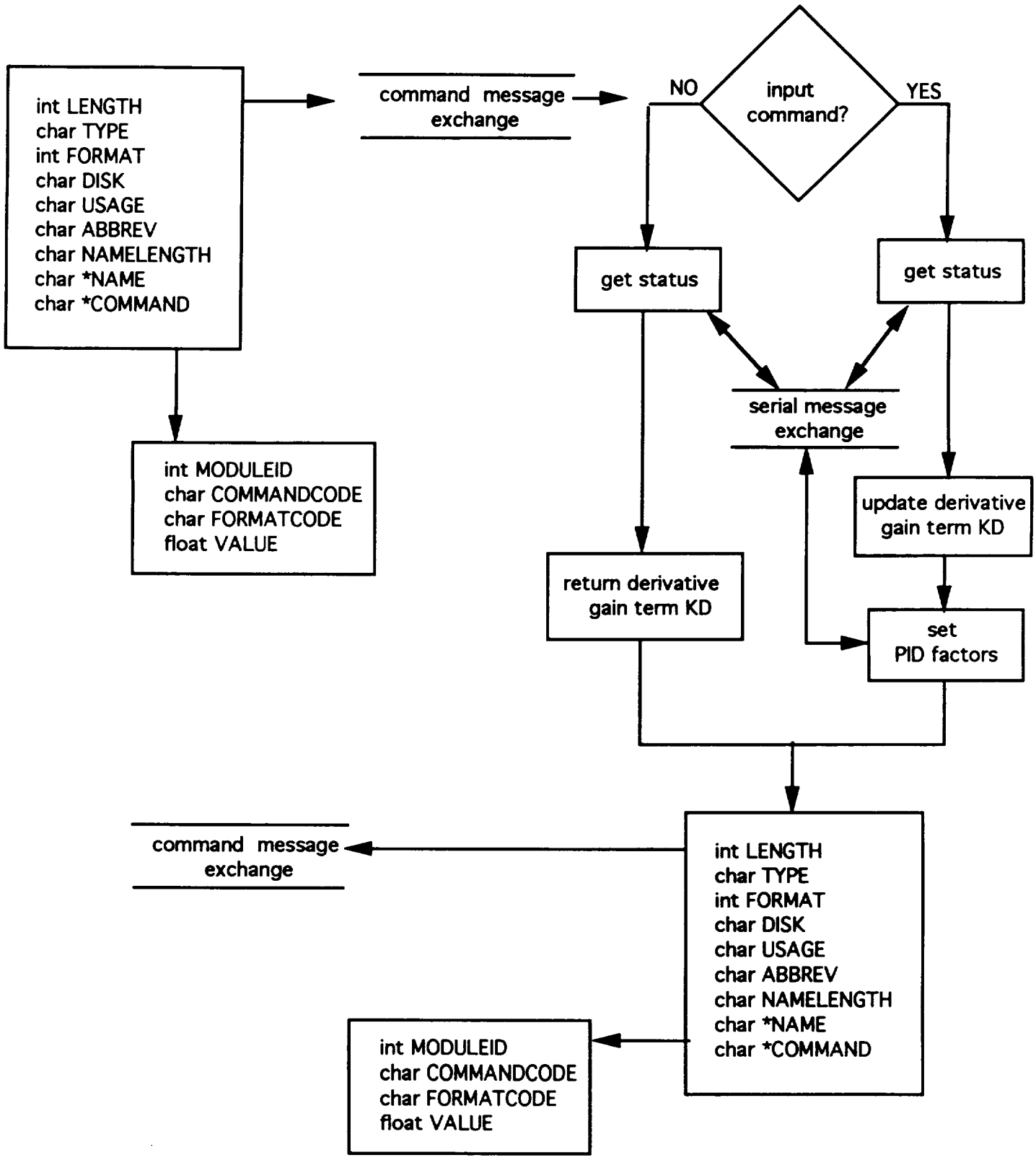
PROPORTIONAL GAIN COMMAND
COMMANDCODE #27



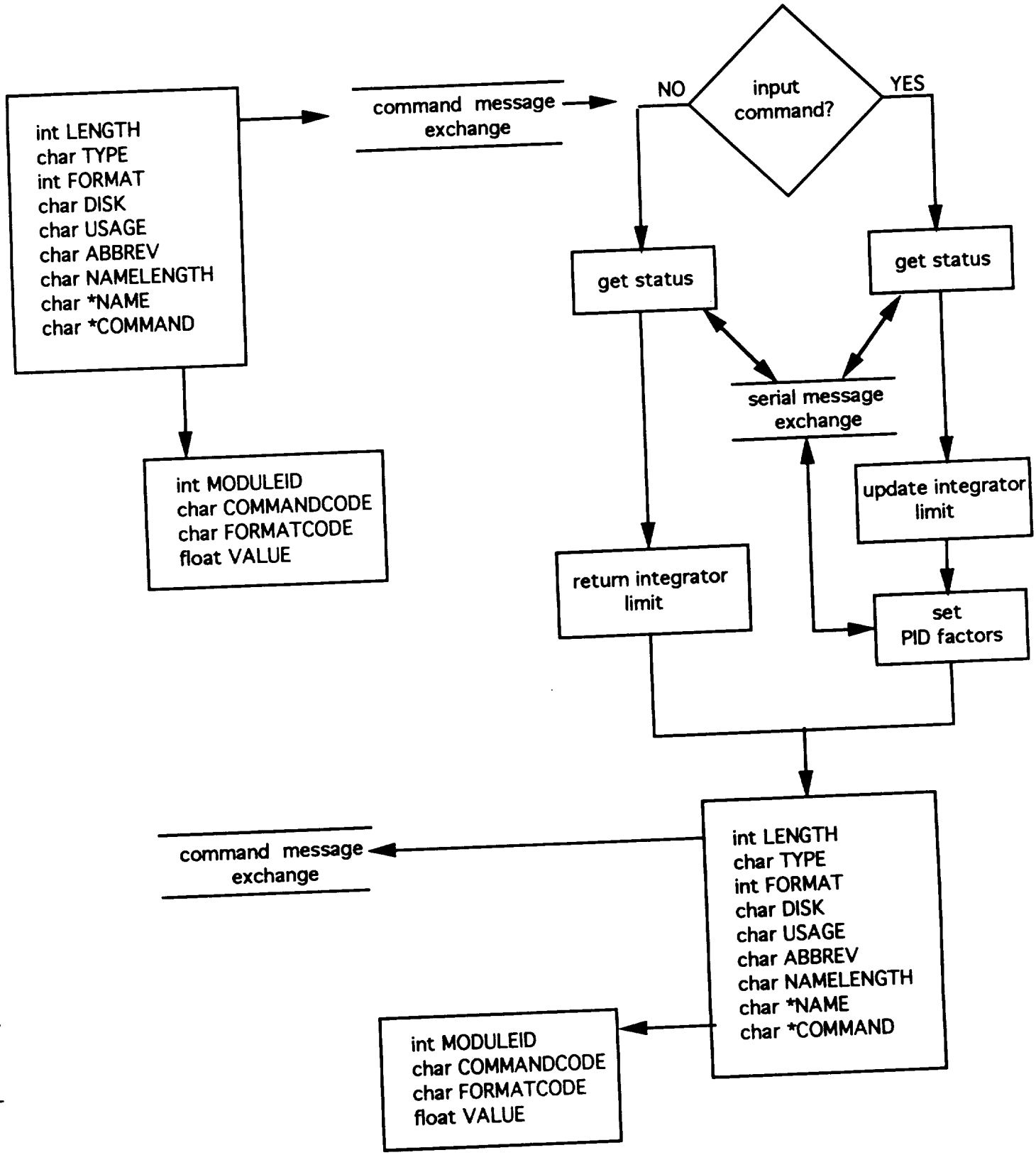
INTEGRAL GAIN COMMAND
COMMANDCODE #28



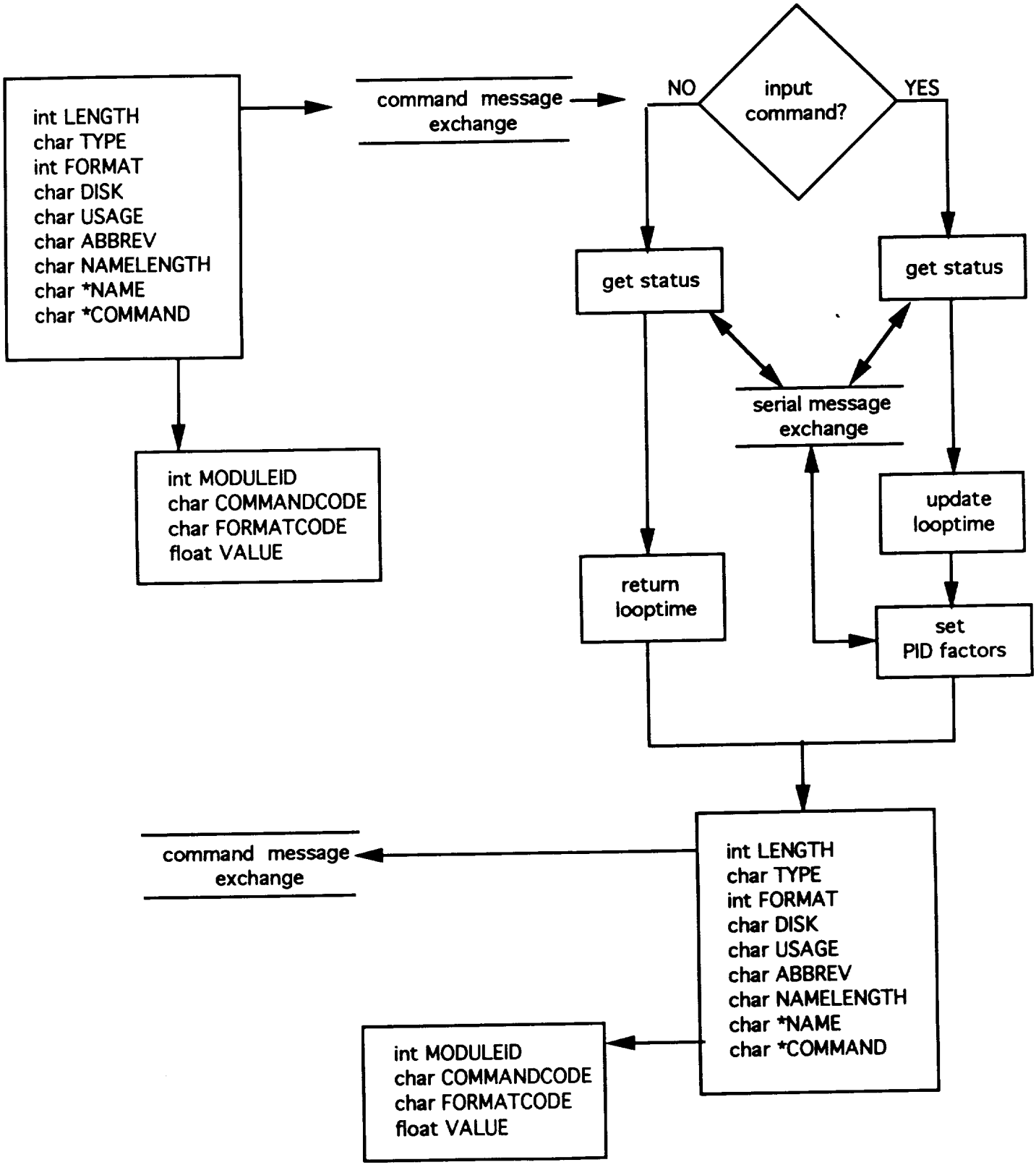
DERIVATIVE GAIN COMMAND
COMMANDCODE #29



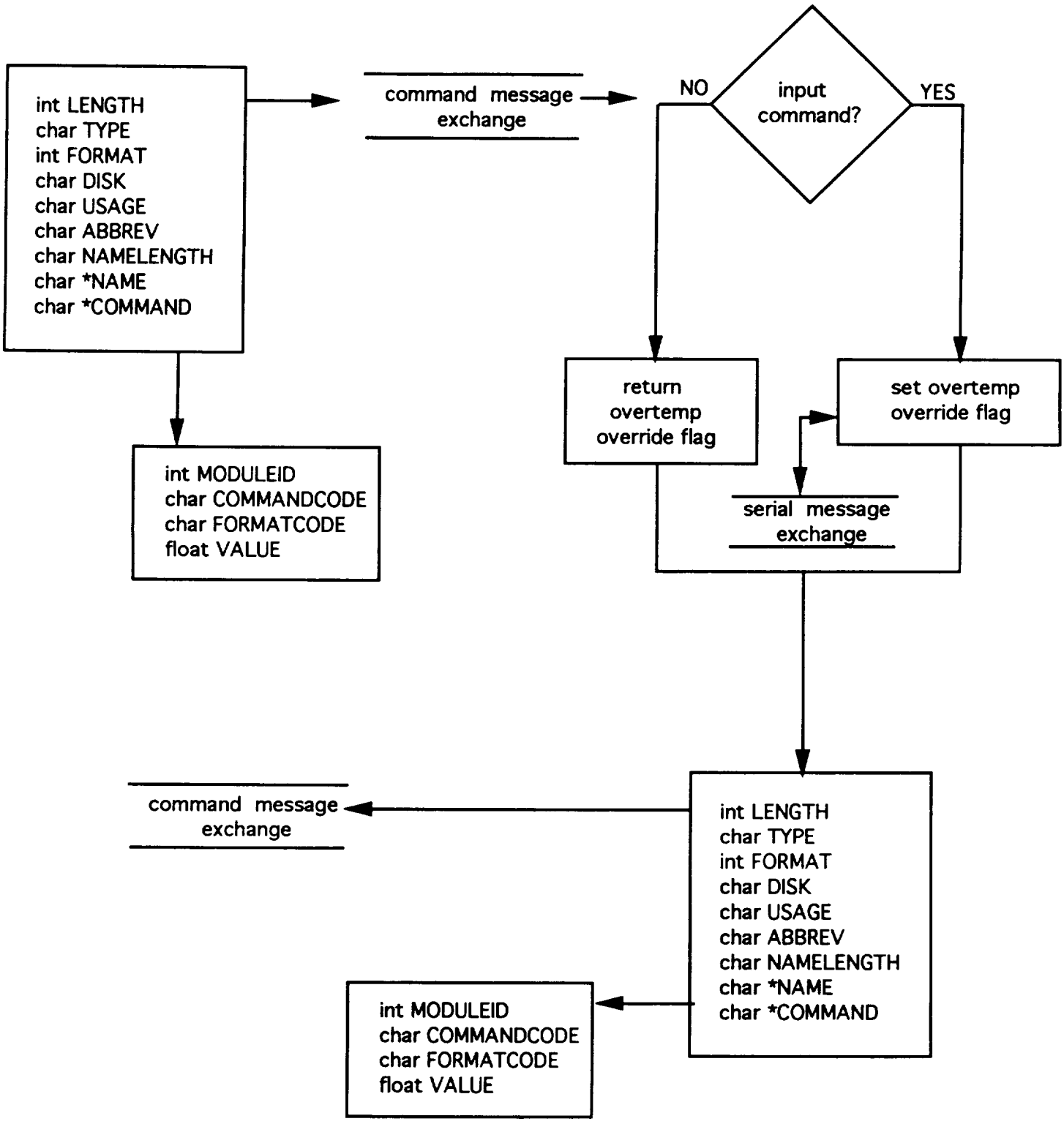
INTEGRATOR LIMIT COMMAND
COMMANDCODE #30



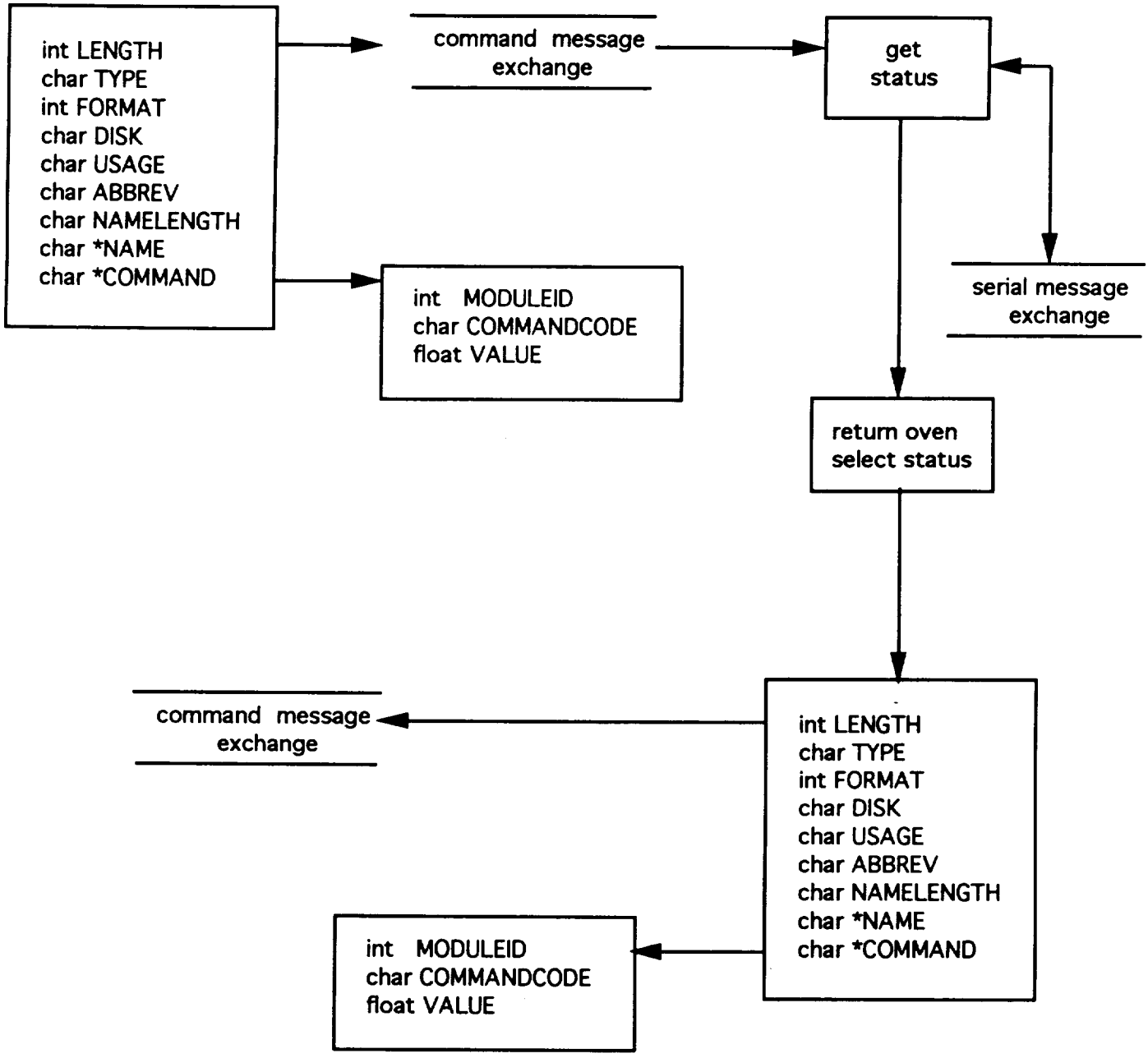
LOOPTIME COMMAND
COMMANDCODE #31



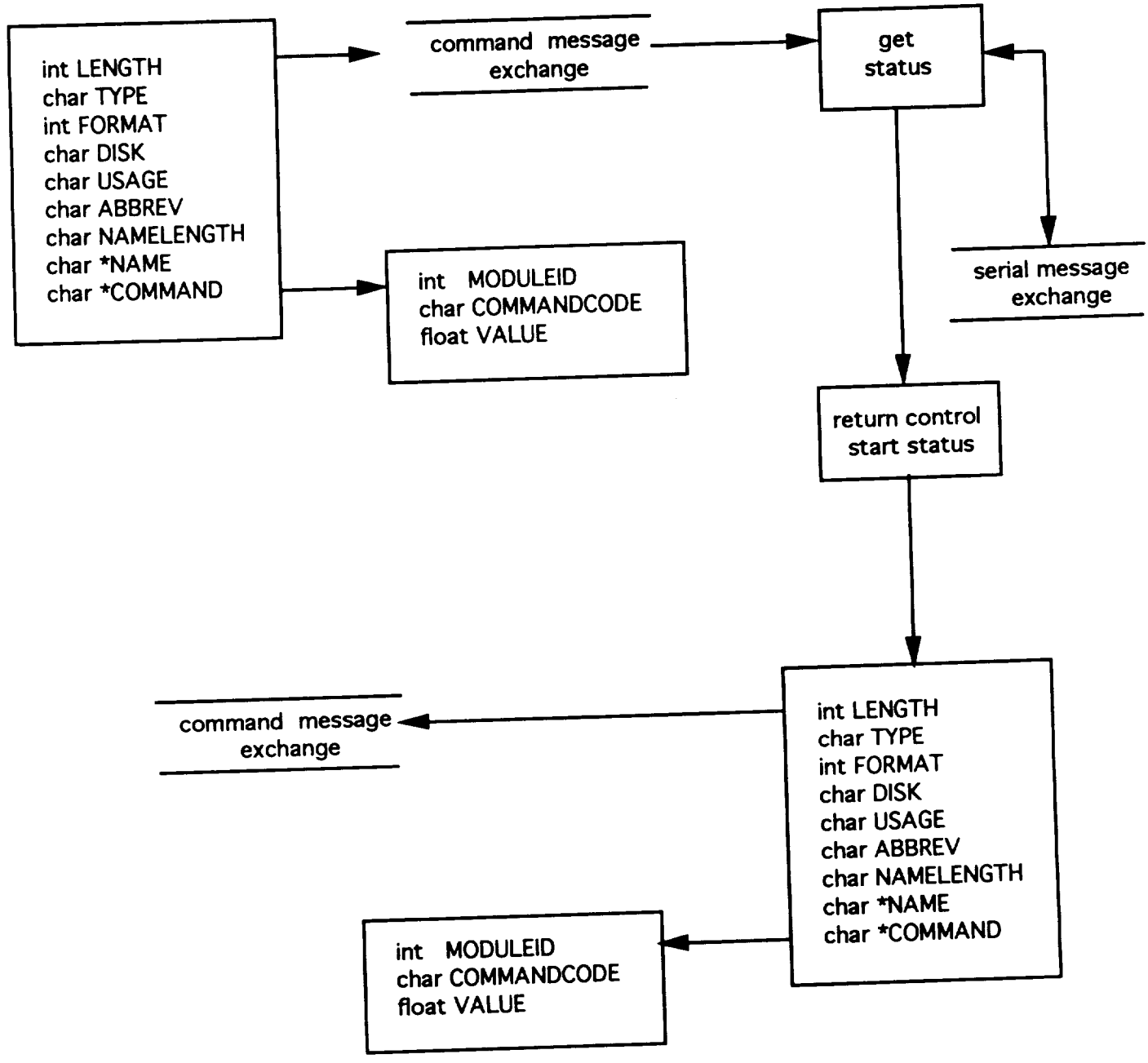
OVERTEMP OVERRIDE COMMAND
COMMANDCODE #32



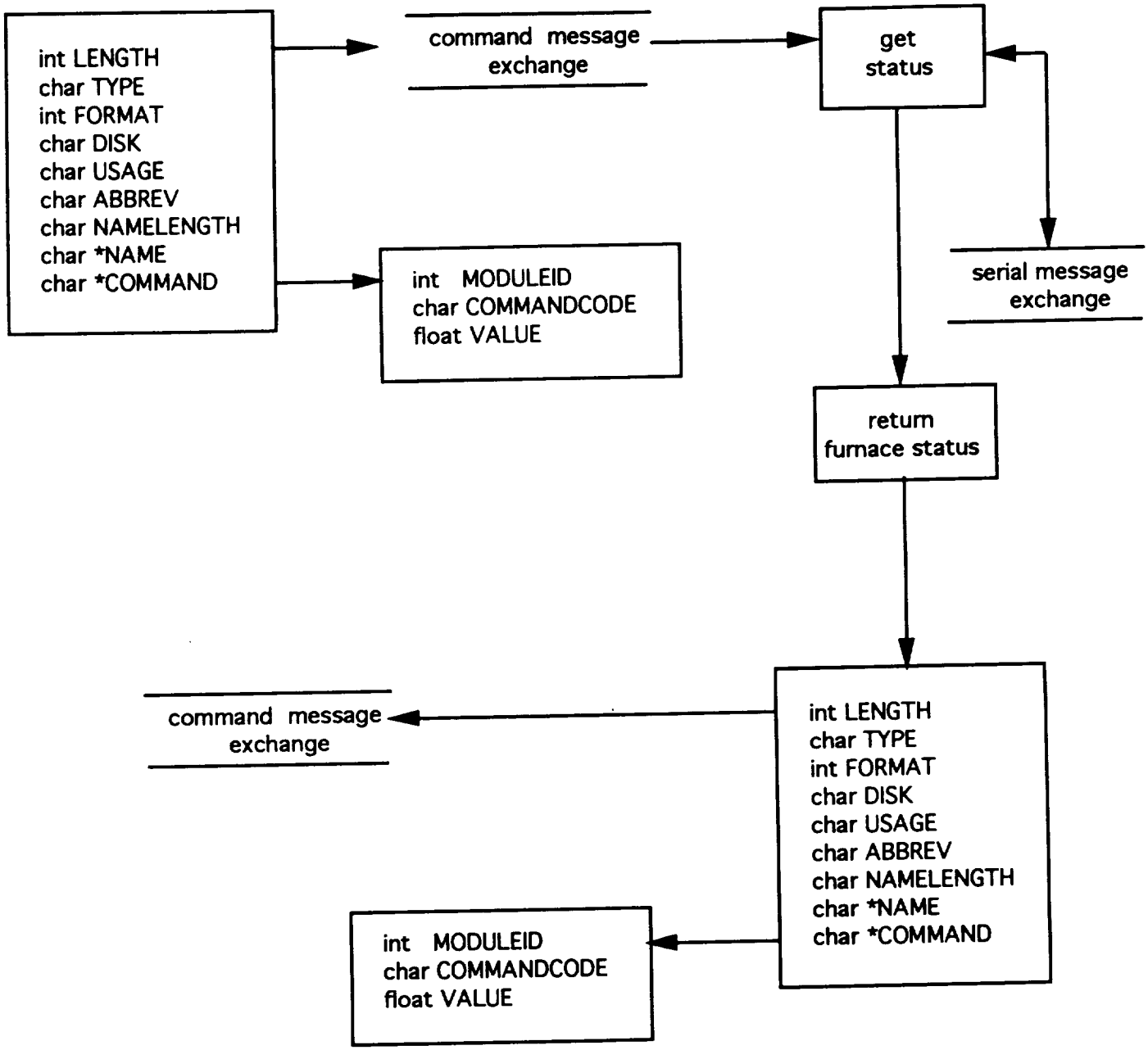
SELECT STATUS COMMAND
COMMANDCODE #33



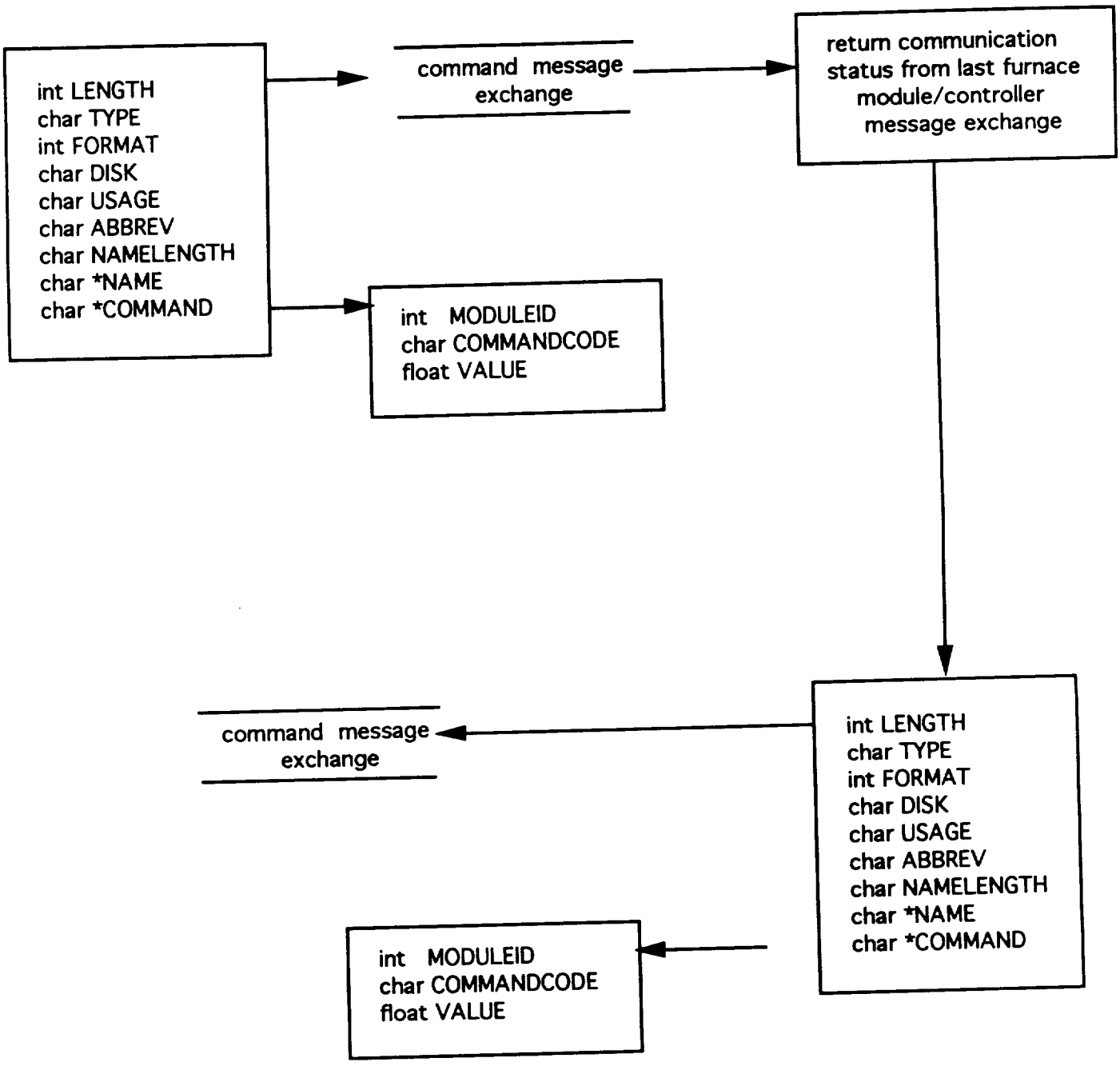
CONTROL START STATUS COMMAND
COMMANDCODE #34



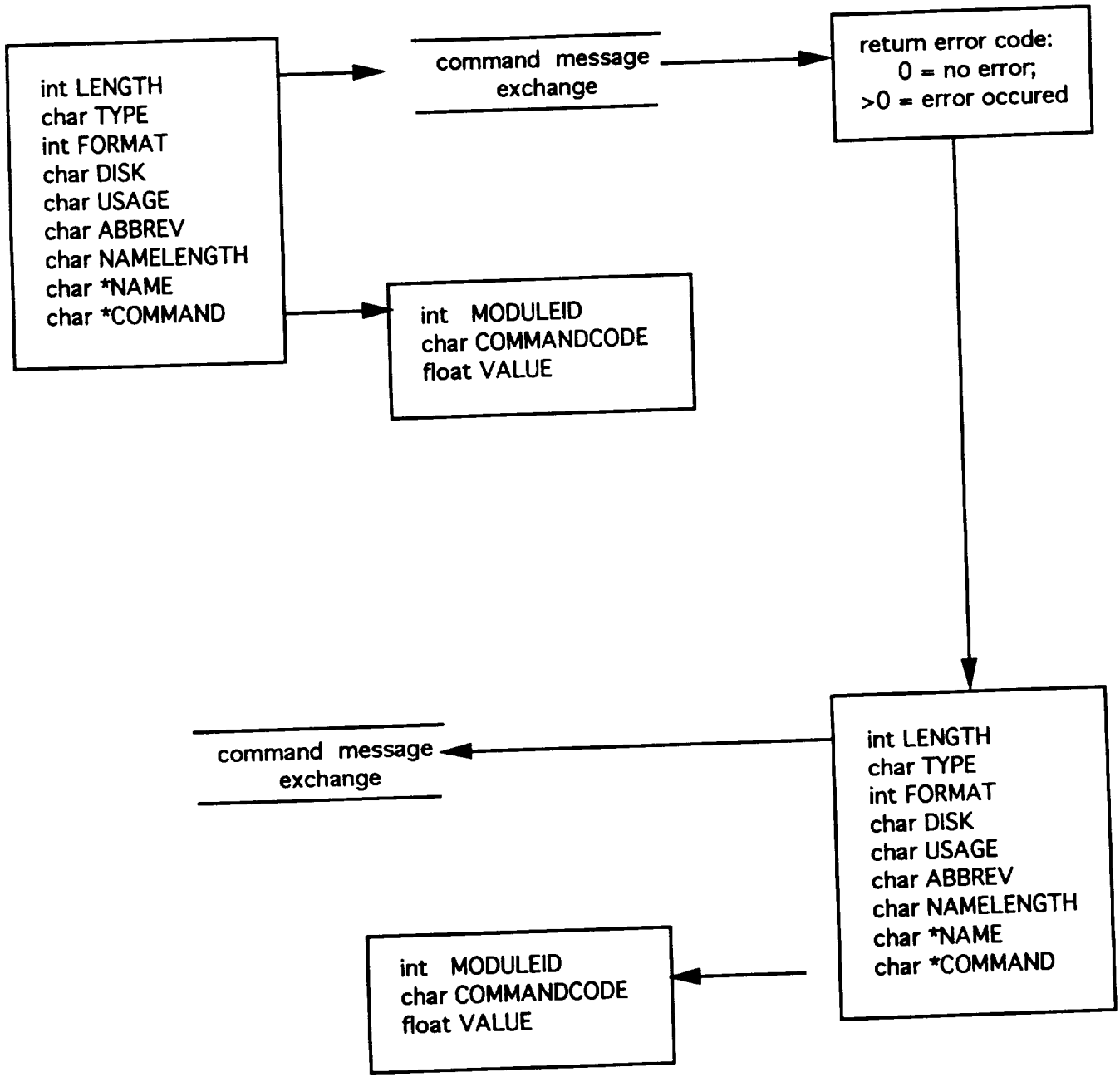
FURNACE STATUS COMMAND
COMMANDCODE #35



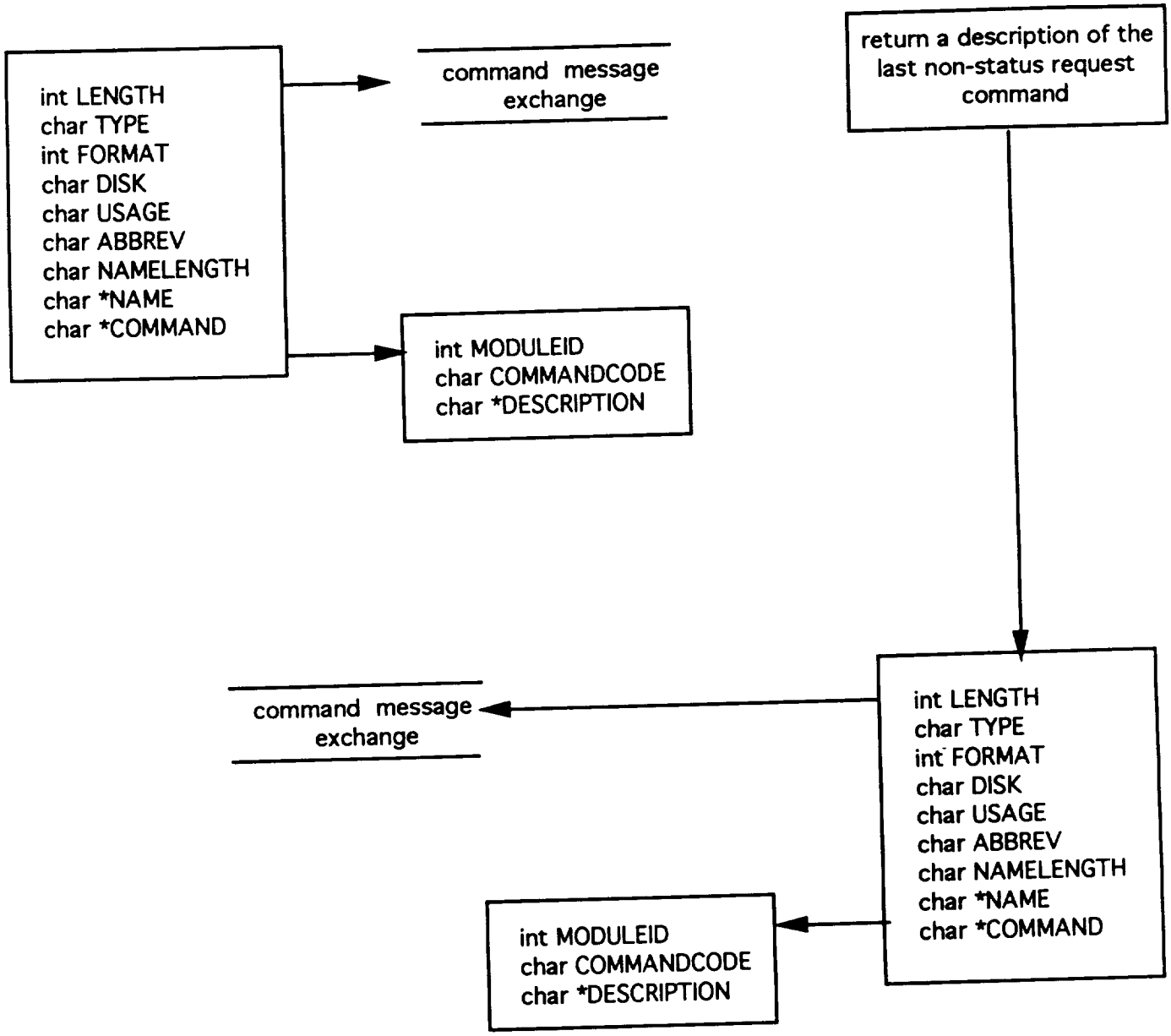
COMMUNICATION STATUS COMMAND
COMMANDCODE #36



MODULE STATUS COMMAND
COMMANDCODE #37



ERROR DESCRIPTION COMMAND
COMMANDCODE #38



EASYLAB PROGRAMS
DEFINITIONS

FURNACE MODULE
EASYLAB PROGRAMS

Space Automated Research Center (SpARC)

December 3, 1992

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GET.FROM.FURNACE 2
PUT.INTO.FURNACE 2

NAME: GET.FROM.FURNACE

SYNTAX: GET.FROM.FURNACE

DESCRIPTION: Remove a sample from a furnace. A sample must be in the furnace.

RETURNS:
OK - successful return
NOTOK - error return

In addition to a NOTOK error return, a message is printed on the terminal and F:MODULE.STATUS is set to indicate the error.

EXAMPLE:
```
RACK.NUMBER = 1
SAMPLE.NUMBER = 5
GET.FROM.RACK
FURNACE.NUMBER = A
PUT.INTO.FURNACE
GET.FROM.FURNACE
```

NAME: PUT.INTO.FURNACE

SYNTAX: PUT.INTO.FURNACE

DESCRIPTION: Put a sample into a furnace. A sample must be in the robot hand and the furnace number must be defined before this command is executed.

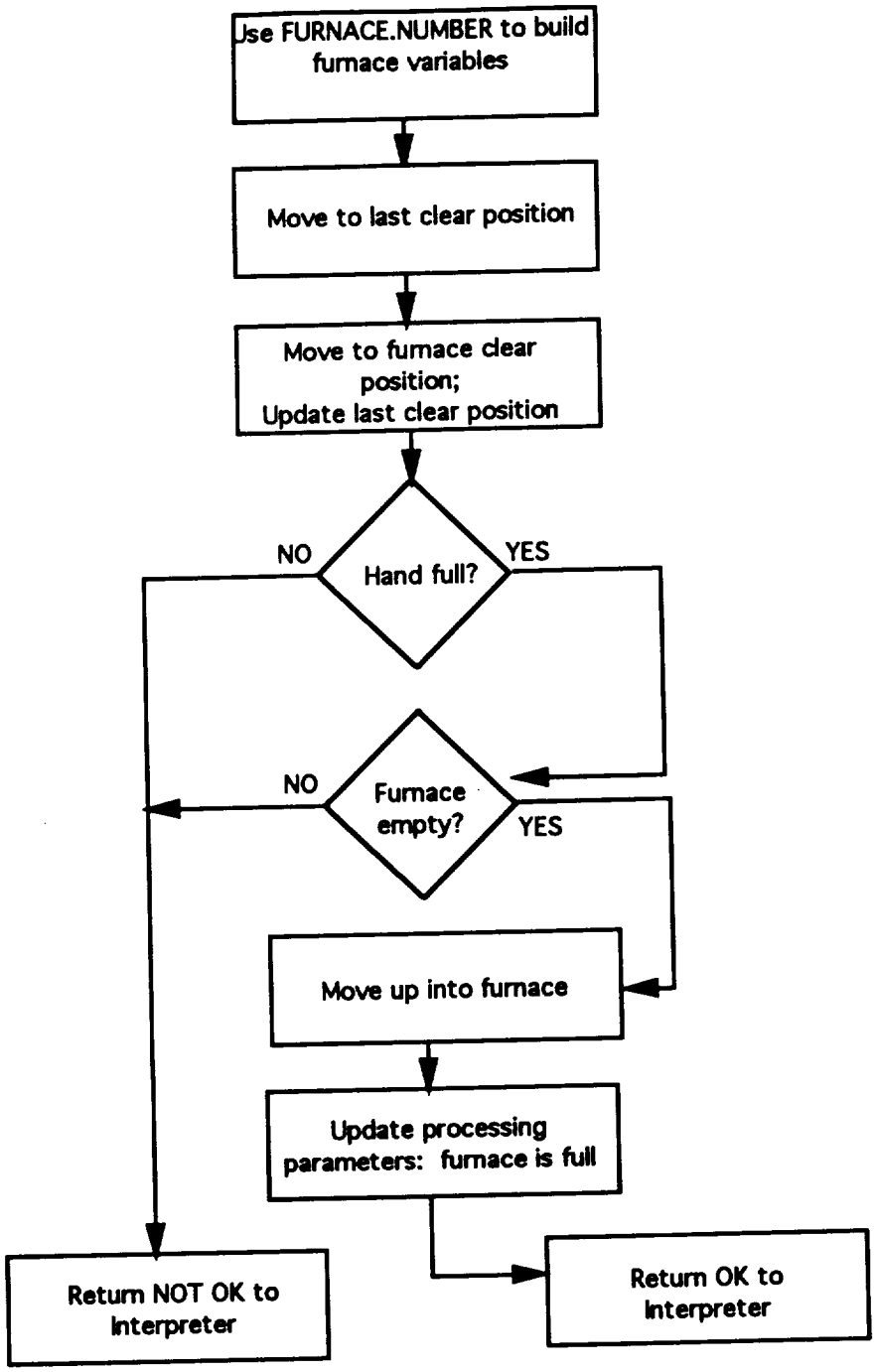
RETURNS:
OK - successful return
NOTOK - error return

In addition to a NOTOK error return, a message is printed on the terminal and F:MODULE.STATUS is set to indicate the error.

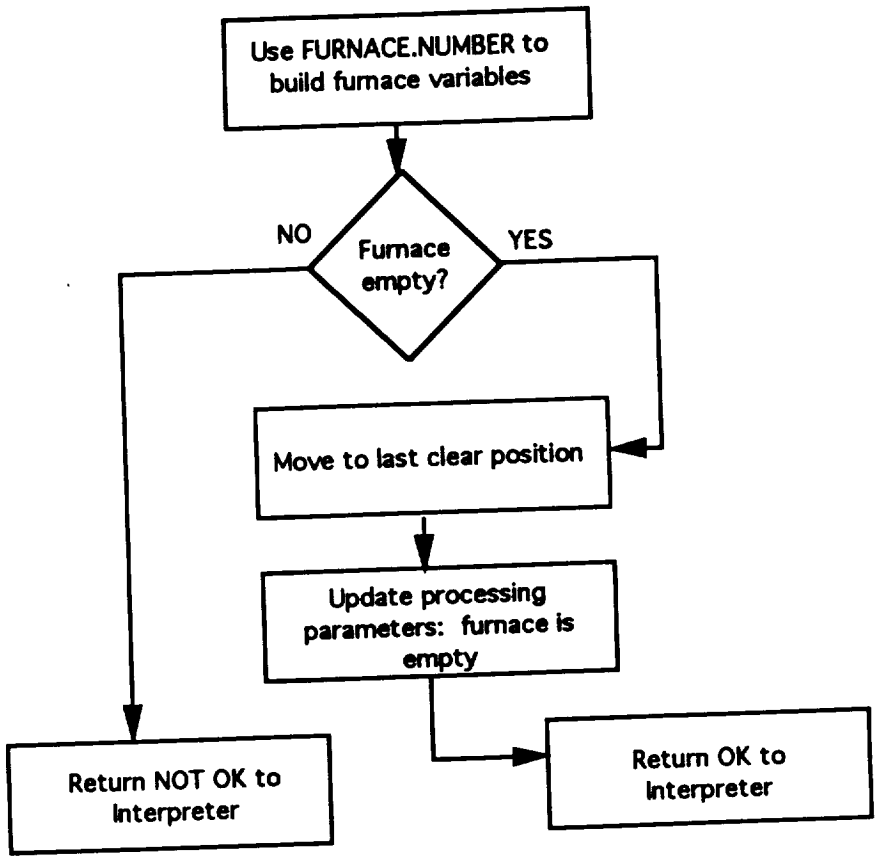
EXAMPLE:
```
RACK.NUMBER = 1
SAMPLE.NUMBER = 5
GET.FROM.RACK
FURNACE.NUMBER = B
PUT.INTO.FURNACE
```

FURNACE
EASYLAB PROGRAMS
FLOW CHARTS

EASYLAB PROGRAM: PUT.INTO.FURNACE
PROCESSING FLOW CHART



EASYLAB PROGRAM: GET.FROM.FURNACE
PROCESSING FLOW CHART



FURNACE MODULE
FAULT CONDITIONS

Furnace Module Software
Fault Handling Summary

Fault Condition	Fault Detection	Fault Response
STOP EZC Processing	User presses STOP key OR System ISR updates EZC Processing status monitored by Stop Task.	Stop Task sends "SET POWER = 0" and "SET TEMPERATURE = 0" commands to Furnace Controller. Furnace Task updates Error Status and terminates command.
Furnace/Furnace Controller Communication Error	Furnace Task sends a message to the Furnace Controller; Furnace Controller sends a one byte error code in response.	Furnace Task attempts to send the message until the retries are exhausted, then updates Error Status and terminates command.
Invalid controller command, 28V bus too low to achieve setpoint, overtemp occurred, invalid checksum, setpoint out of range, watchdog timeout	Furnace Task sends a "READ STATUS" message to the Furnace Controller; Furnace Controller sends ten status bytes in response.	Furnace Task updates Error Status and terminates command.
Invalid Command	Furnace Task compares Command Code to valid Command Codes.	Furnace Task updates Error Status and terminates command.
Command Is Not For This Furnace	Furnace Task compares Command Module ID to it's own Module ID	Furnace Task updates Error Status and terminates command.