9 Control word and status word

9.1 Description of the control word bits

The operating statuses can be read in visualization parameter r001:
e.g. READY TO POWER-UP: r001 = 009

The function sequences are described in the sequence in which they are actually realized.

Function diagrams 180 and 190 refer to further function diagrams in the Compendium.

Bit 0: ON/OFF 1 command (↑ "ON") / (L "OFF1")

Condition

Positive edge change from L to H (L → H) in the READY TO POWER-UP condition (009).

Result

- PRECHARGING (010)
  Main contactor (option)/bypass contactor, if available, are switched-in (closed).
  The DC link is pre-charged.
- READY (011)
  If the drive was last powered-down with "OFF2", the next condition is only selected after the de-energization time (P603) has expired since the last shutdown
- GROUND FAULT TEST (012), only when the ground fault test has been selected (P375).
- RESTART ON THE FLY (013), if restart on the fly (control word bit 23 via P583) has been enabled**.**
- RUN (014).

Condition

LOW signal and P100 = 3, 4 (closed-loop frequency/speed control)

Result

- OFF1 (015), if the drive is in a status where the inverter is enabled.
  - For P100 = 3, 4 and slave drive, the system waits until the higher-level open-loop/closed-loop control shuts down the drive.
  - For P100 = 3, 4 and master drive, the setpoint at the ramp-function generator input is inhibited (setpoint = 0), so that the drive decelerates along the parameterized down ramp (P464) to the OFF shutdown frequency (P800).

  After the OFF delay time (P801) has expired, the inverter pulses are inhibited, and the main contactor (option/bypass contactor), if available, are opened.
  If the OFF1 command is withdrawn again when the drive is ramping-down, (e.g. as the result of an ON command), ramp-down is interrupted, and the drive goes back into the RUN (014) condition.

- For PRECHARGING (010), READY (011), RESTART-ON-THE-FLY (013) or MOT-ID-STANDSTILL (018), the inverter pulses are inhibited, and the main contactor (option)/bypass contactor, if available, is opened.
- SWITCH-ON INHIBIT (008); compare status word 1, bit 6
- READY-TO-POWER-UP (009), if "OFF2" or "OFF3" are not present.

Condition Low signal and P100 = 5 (closed-loop torque control)

Result
- An OFF2 command (electrical) is executed.

Bit 1: OFF2 command (L "OFF2") electrical

Condition LOW signal

Result
- The inverter pulses are inhibited, and the main contactor (option)/bypass contactor, if available, are opened.
- POWER-ON INHIBIT (008), until the command is removed.

NOTE The **OFF2** command is simultaneously connected from three sources (P555, P556 and P557)!

Bit 2: OFF3 command (L "OFF3") (fast stop)

Condition LOW signal

Result
- This command has two possible effects:
  - DC braking is enabled (P395 = 1):
    DC BRAKING (017)
    The drive decelerates along the parameterized downramp for OFF3 (P466) until the frequency for the start of DC braking is reached (P398).
    The inverter pulses are then inhibited for the duration of the de-energization time (P603).
    After this, the drive DC brakes with an adjustable braking current (P396) for a braking time which can be parameterized (P397).
    The inverter pulses are then inhibited and the main contactor (option)/bypass contactor, if available, is opened.
  - DC braking is not enabled (P395 = 0):
    The setpoint is inhibited at the ramp-function generator input (setpoint = 0), so that the drive decelerates along the parameterized downramp for OFF3 (P466) to the OFF shutdown frequency (P800).
    The inverter pulses are inhibited after the OFF delay time (P801) has expired, and the main/bypass contactor, if used, is opened. If the OFF3 command is withdrawn while the drive is decelerating, the drive still continues to accelerate.

- For PRE-CHARGING (010), READY (011), RESTART-ON-THE-FLY (013) or MOT-ID STANDSTILL (018), the inverter pulses are inhibited, and the main/bypass contactor, if used, is opened.
- If the drive operates as slave drive, when an OFF3 command is issued, it automatically switches-over to the master drive.
- POWER-ON inhibit (008), until the command is withdrawn.

NOTE

The **OFF3** command is simultaneously effective from three sources (P558, P559 and P560)!

Priority of the **OFF** commands: **OFF2** > **OFF3** > **OFF1**

Bit 3: Inverter enable command (H "inverter enable")/(L "inverter inhibit")

Condition HIGH signal, READY (011) and the de-energization time (P603) has expired since the last time that the drive was shutdown.

Result
- RUN (014)
  The inverter pulses are enabled and the setpoint is approached via the ramp-function generator.

Condition LOW signal

Result
- For RESTART-ON-THE-FLY (013), RUN (014), KINETIC BUFFERING with pulse enable, OPTIMIZATION OF THE SPEED CONTROLLER CIRCUIT (019) or SYNCHRONIZATION (020):
- The drive changes over into the READY (011), condition, and the inverter pulses are inhibited.
- If OFF1 is active (015), the inverter pulses are inhibited, the main/bypass contactor, if used, is opened, and the drive goes into the POWER-ON INHIBIT (008) condition.
- If OFF3 is active (016 / fast stop), the inverter inhibit command is ignored, fast stop is continued and, after shutdown (P800, P801), the inverter pulses are inhibited.

Bit 4: Ramp-function generator inhibit command (L "RFG inhibit")

Condition LOW signal in the RUN (014) condition.

Result
- The ramp-function generator output is set to setpoint = 0.

Bit 5: Ramp-function generator hold command (L "RFG hold")

Condition LOW signal in the RUN (014) condition.

Result
- The actual setpoint is "frozen at the ramp-function generator output".

Bit 6: Setpoint enable command (H "setpoint enable")

Condition HIGH signal and the de-energization time have expired (P602).

Result
- The setpoint at the ramp-function generator input is enabled.

Bit 7: Acknowledge command (↑ "Acknowledge")

Condition Rising (positive) edge change from L to H (L → H) in the FAULT condition (007).

Result
- All of the current faults are deleted after they have been previously transferred into the diagnostics memory.
- POWER-ON INHIBIT (008), if no actual faults are present.
- FAULT (007), if there are no faults.

NOTE The **Acknowledge** command is simultaneously effective from the three sources (P565, P566 and P567) and always from the PMU!

Bit 8: Inching 1 ON command (↑ "Inching 1 ON") / (L "Inching 1 OFF")

Condition Positive (rising) edge change from L to H (L → H) in the READY TO POWER-UP (009) condition.

Result
- An ON command is automatically executed (refer to control word bit 0), and inching frequency 1 (P448) is enabled in the setpoint channel.
  The ON/OFF1 command (bit 0) is ignored for active inching operation!
  The system must wait until the de-energization time (P603) has expired

Condition LOW signal

Result
- An OFF1 command is automatically executed (refer to control word bit 0).

Bit 9: Inching 2 ON command (↑ "Inching 2 ON") / (L "Inching 2 OFF")

Condition Rising (positive) edge change from L to H (L → H) in the READY TO POWER-UP (009) condition.

Result
- An ON command is automatically executed (refer to control board bit 0), and inching frequency 2 (P449) is enabled in the setpoint channel.
  The ON/OFF1 command (bit 0) is ignored if inching is active.
  The system must wait until the de-energization time (P603) has expired.

Condition LOW signal

Result
- An OFF1 command is automatically executed (refer to control word bit 0).

Bit 10: Control from the PLC command (H "control from the PLC")

Condition	HIGH signal; the process data PZD (control word, setpoints) are only evaluated if the command has been accepted; this data is sent via the SST1 interface of the CU, the CB/TB interface (option) and the SST/SCB interface (option).
Result	♦ If several interfaces are used, only the process data of the interfaces are evaluated, which send an H signal. ♦ For an L signal, the last values are received in the appropriate dual port RAM of the interface.
NOTE	An H signal appears in the visualization parameter r550 "control word 1", if **one** of the interfaces sends an H signal!

Bit 11: Clockwise rotating field command (H "clockwise rotating field")

Condition	HIGH signal
Result	♦ The setpoint is influenced in conjunction with bit 12 "counter-clockwise rotating field".

Bit 12: Counter-clockwise rotating field command (H "counter-clockwise rotating field")

Condition	HIGH signal
Result	♦ The setpoint is influenced in conjunction with bit 11 "clockwise-rotating field".
NOTE	The **counter-clockwise rotating field** and the **clockwise rotating field** command have no influence on supplementary setpoint 2, which is added after the ramp-function generator (RFG)!

Bit 13: Command to raise the motorized potentiometer (H "raise motorized potentiometer")

Condition	HIGH signal
Result	♦ The motorized potentiometer in the setpoint channel is driven in conjunction with bit 14 "motorized potentiometer, lower".

Bit 14: Command to lower the motorized potentiometer (H "lower motorized potentiometer")

Condition	HIGH signal
Result	♦ The motorized potentiometer in the setpoint channel is driven in conjunction with bit 13 "raise motorized potentiometer".

Bit 15: Command external fault 1 (L "External fault 1")

Condition	LOW signal
Result	♦ FAULT (007) and fault message (F035). The inverter pulses are inhibited, the main contactor/bypass contactor, if used, is opened**.**

Bit 16: Function data set FDS bit 0 command

Result
- In conjunction with bit 17 "FDS BIT 1" one of the four possible function data sets is energized.

Bit 17: Function data set FDS bit 1 command

Result
- In conjunction with bit 16 "FDS BIT 0" one of the four possible function data sets is energized.

Bit 18: Motor data set, MDS bit 0 command

Condition READY TO POWER-UP (009), PRE-CHARGING (010) or READY (011)

Result
- One of the four possible motor data sets is energized in conjunction with bit 19 "MDS BIT 1".

Bit 19: Motor data set, MDS bit 1 command

Condition READY TO POWER-UP (009), PRE-CHARGING (010) or READY (011)

Result
- One of the four possible motor data sets is energized in conjunction with bit 18 "MDS BIT 0".

Bit 20: Fixed setpoint FSW bit 0 (LSB) command

Result
- In conjunction with bit 21 "FSW BIT 1", one of the four possible fixed setpoints is energized to input as percentage fixed setpoints, referred to the reference frequency P352 or reference speed P353.

Bit 21: Fixed setpoint FSW bit 1 (MSB) command

Result
- In conjunction with bit 20 "FSW BIT 0" one of the four possible fixed setpoints is energized for input as percentage fixed setpoints, referred to the reference frequency P352 or the reference speed P353.

Bit 22: Synchronizing enable command (H "synchronizing enable")

Condition
- For converter sychronization (P534 = 1):
  HIGH signal, TSY (option) available and P100 = 2 (V/f characteristic for textile applications).
- For line synchronization (P534 = 2):
  HIGH signal, TSY (option) P100 = 1, 2 or 3

Result
- The command enables the synchronizing function.

Bit 23: Restart-on-the-fly enable command (H "restart-on-the-fly enable")

Condition	HIGH signal
Result	♦ The command enables the restart-on-the-fly function.

Bit 24: Droop/technology controller enable command (H "droop/technology controller enable")

Condition	HIGH signal
Result	♦ The command enables the droop function, if P100 (open-loop/closed-loop control type) is assigned 3 (closed-loop frequency control) or 4 (closed-loop speed control), parameter P246 <> 0 and the inverted pulses of the drive converter are enabled. The speed/frequency controller output, fed back as negative signal to the speed/frequency setpoint, can be set via parameter P245 (source steady-state) and P246 (scaling steady-state)

Bit 25: Controller enable command (H "controller enable")

Condition	HIGH signal and the drive converter inverter pulses are enabled.
Result	♦ The speed controller output is enabled for the appropriate control type (P100 = 0,4,5).

Bit 26: Command, external fault 2 (L "External fault 2")

Condition	LOW signal; it is only activated from the READY (011) condition onwards and after an additional time delay of 200 ms.
Result	♦ FAULT (007) and fault message (F036). The inverter pulses are inhibited, the main contactor, if available, is opened.

Bit 27: Slave/master drive command (H "Slave drive")/(L "Master drive")

Condition	HIGH signal, P100 (open-loop/closed-loop control type) = 3, 4 (closed-loop frequency/speed control), and the drive inverter pulses are enabled.
Result	♦ Slave drive: The closed-loop control acts as closed-loop torque control (M closed-loop control). With f closed-loop control, precise torque control is not possible until from about 10 % of motor rated speed onwards.
Condition	LOW signal, P100 (open-loop/closed-loop control type) = 3, 4 (closed-loop frequency/speed control), and the drive converter inverter pulses are enabled.
Result	♦ Master drive: The closed-loop control operates as closed-loop speed or frequency control (closed-loop frequency/speed control).

Bit 28: Command, external alarm 1 (L "External alarm 1")

Condition	LOW signal
Result	♦ The operating status is maintained. An alarm message is issued (A015).

Bit 29: Command, external alarm 2 (L "External alarm 2")

Condition	LOW signal
Result	♦ The operating status is maintained. An alarm message is issued (A016).

Bit 30: Select, BICO data sets (H "data set 2") / (L "data set 1")

Condition	HIGH signal
Result	♦ The parameter settings of data set 2 for all binector and connector commands and signals, are activated.
Condition	LOW signal
Result	♦ The parameter settings of data set 1 for all binector and connector commands and signals, are activated.

Bit 31: Main contactor checkback signal command (H "main contactor checkback signal")

Condition	HIGH signal, corresponding to the wiring and parameterization of the main contactor (option). The checkback time can be set in P600.
Result	♦ Checkback signal, "main contactor energized" (closed).

9.2 Description of the status word bits

Bit 0: Message, "Ready to power-up" (H)

HIGH signal POWER-ON INHIBIT (008) or READY TO POWER-UP (009) status

Significance

- The power supply, the open- and closed-loop control are operational.
- The inverter pulses are inhibited.
- If an external power supply and a main contactor (option)/bypass contactor are available, it is possible to bring the DC link into a no-voltage condition, when the drive converter is in this status!

Bit 1: Message, "Ready" (H)

HIGH signal PRE-CHARGING (010) or READY (011) status

Significance

- The power supply, the open-loop and the closed-loop control are operational.
- The unit is powered-up.
- Pre-charging has been completed.
- The DC link has been ramped-up to the full voltage.
- The inverter pulses are still inhibited.

Bit 2: Message, "Run" (H)

HIGH signal RESTART-ON-THE-FLY (013), RUN (014), OFF1 (015) or OFF3 (016)

Significance

- The unit is functioning.
- The inverter pulses are enabled.
- The output terminals are live.

Bit 3: Message "Fault" (H)

HIGH signal Fault (007) status

Significance

- A fault has occurred.

Bit 4: Message "OFF2" (L)

LOW signal OFF2 command available

Significance

- The OFF2 command was output (control word bit 1).

Bit 5: Message "OFF3" (L)

LOW signal OFF3 (016) status, and/or OFF3 command available

Significance

- The OFF3 command was output (control word bit 2).

Bit 6: Message "Power-on inhibit" (H)

HIGH signal POWER-ON INHIBIT (008) status

Significance

- The power supply, open-loop and closed-loop control are operational.
- If an external power supply and a main contactor (option)/bypass contactor are available, it is possible to bring the DC link voltage in this drive converter status into a no-voltage condition!
- The message is available as long as an OFF2 command is present via control word bit 1 or an OFF3 command is available via control word bit 2 after the setpoint has been ramped-down, or an ON command is available via control word bit 0 (edge evaluation).

Bit 7: Message, "Alarm" (H)

HIGH signal Alarm (Axxx)

Significance

- An alarm has been issued.
- The signal is present until the cause has been resolved.

Bit 8: Message "Setpoint-actual value deviation" (L)

LOW signal Alarm, "Setpoint-actual value deviation" (A034)

Significance

- The frequency actual value deviates from the frequency setpoint (reference value, by a value which exceeds P794 (setpoint-actual value deviation, frequency), for a time which is longer than P792 (setpoint-actual value deviation time).
- The bit is again set as H signal, if the deviation is less than parameter value P792.

Bit 9: Message "PZD control requested" (H)

HIGH signal Still present.

Bit 10: Message, "Comparison frequency reached" (H)

HIGH signal The parameterized comparison frequency has been reached.

Significance

- The absolute frequency actual value is greater than or equal to the parameterized comparison frequency (P796).
- The bit is again set to L signal, as soon as the absolute value of the comparison frequency (P796), minus the parameterized comparison frequency hysteresis (P797 as %, referred to the comparison frequency (P796)) is fallen below.

Bit 11: Message "Fault, undervoltage" (H)

HIGH signal "Undervoltage in the DC link" fault (F008)

Significance
- The DC link voltage has fallen below the permissible limit value.

Refer to the Section "Fault- and alarm messages"

Bit 12: Message "Main contactor energized" (H)

HIGH signal The main contactor (AC unit)/precharging contactor (DC unit) (option) is operated.

Significance
- The main contactor/precharging contactor (option) can be driven with the appropriate wiring and parameterization.

Bit 13: Message "RFG active" (H)

HIGH signal Ramp-function generator active

Significance
- The ramp-function generator output (r480 / KK0073) is not equal to the ramp-function generator input (r460 / KK0072).
  A hysteresis, which can be parameterized (P476 as %, referred to the rated system frequency P352), can only be taken into account for an analog setpoint input.
- When the "Synchronizing" function is selected, alarm A069 is initiated, as long as the ramp-function generator is active in the setpoint channel of the synchronizing converter.
  The synchronizing operation is not started as long as the ramp-function generator is active.

Bit 14: Message, "Clockwise rotating field" (H)/ "Counter-clockwise rotating field" (L)

HIGH signal Clockwise rotating field

Significance
- The frequency setpoint for the closed-loop control (speed/frequency setpoint, r482 / KK0075) is greater than or equal to 0.

LOW signal Counter-clockwise rotating field

Significance
- The frequency setpoint for the closed-loop control (speed/frequency setpoint, r482 / KK0075) is less than 0.

Bit 15: Message "KIP/FLN active" (H)

HIGH signal The kinetic buffering (KIP) function or flexible response (FLN) is active.

Significance
- KIP: A brief power failure is bypassed using the kinetic energy of the connected load.
- FLN: The converter can be operated up to a minimum DC link voltage of 50% of the rated value.

Bit 16: Message "Restart-on-the-fly active" (H)

HIGH signal The restart-on-the-fly function is active, or the excitation time (P602) is running.

Significance
- The drive converter is switched to a motor which is still rotating.
- Overcurrent is prevented as a result of the restart-on-the-fly function.
- The excitation time (magnetization time) is active.

Bit 17: Message "Synchronism has been reached" (H)

HIGH signal Synchronism has been reached.

Significance
- Synchronism has been reached.

Prerequisite TSY (option) available and P100 (open-loop/closed-loop control type) = 2 (V/f characteristic for textile applications) or P100 = 1, 2, 3 at line synchronism (P534 = 2).

Bit 18: Message "Overspeed" (L)

LOW signal Alarm "Overspeed" (A033)

Significance
- The frequency actual value is either:
- greater than the maximum frequency for the clockwise rotating field (P452) plus a hysteresis (P804 as %, referred to P452) or
- less than the maximum frequency for the counter-clockwise rotating field (P453) plus a hysteresis (P804 as %, referred to P453).
- The bit is again set to an H signal as soon as the absolute value of the frequency actual value is less than or equal to the absolute value of the appropriate maximum frequency.

Bit 19: Message "External fault 1" (H)

HIGH signal "External fault 1"

Significance
- A "External fault 1" is present in control word, bit 15.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 20: Message "External fault 2" (H)

HIGH signal "External fault 2"

Significance
- A "External fault 2" is present in control word bit 26.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 21: Message "External alarm" (H)

HIGH signal "External alarm"

Significance

- An "external alarm 1" is present in control word bit 28, or, "external alarm 2" in control word bit 29.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 22: Message "Alarm i^2t drive converter" (H)

HIGH signal Alarm "i^2t alarm, inverter" (A025)

Significance

- If the instantaneous load status is maintained, then the drive converter will be thermally overloaded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 23: Message "Fault, converter overtemperature" (H)

HIGH signal "Inverter temperature too high" fault (F023)

Significance

- The limiting inverter temperature has been exceeded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 24: Message "Alarm, converter overtemperature" (H)

HIGH signal Alarm, "inverter temperature too high" (A022)

Significance

- The inverter temperature threshold to release an alarm has been exceeded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 25: Message "Alarm, motor overtemperature" (H)

HIGH signal Alarm "Motor overtemperature"

Significance

- It involves an "I^2t alarm, motor" (A029) or an overtemperature alarm from the KTY (P380 > 1) or PTC thermistor (P380 = 1).
- The alarmis initiated either by calculating the motor load (r008 / K0244) or from the KTY84 sensor (r009 / K0245).
- Parameters involved in the calculation:
  P380 (mot. temp. alarm), P382 (motor cooling),
  P383 (mot. temp.T1), P384 (mot. load limit).

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 26: Message "Fault, motor overtemperature" (H)

HIGH signal Fault, "Motor overtemperature"

Significance
- It involves an "I^2t fault, motor" (F021) or an overtemperature fault, from KTY (P381 > 1) or PTC thermistor (P381 = 1).

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 27: Reserve

Bit 28: Message, "Fault, motor stalled/locked" (H)

HIGH signal Fault, "Motor stalled or blocked" (F015)

Significance
- The drive has either stalled or is locked.

Precondition
- Blocking recognition at P100 = 3, 4 f/n control: setpoint/actual value deviation has occurred (bit 8), torque limit (B0234) reached, speed < 2 % and time in P805 expired
- In the case of M control (P100 = 5) or slave drive (P587), blocking is not recognized.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 29: Message "Bypass contactor energized" (H)

HIGH signal The bypass contactor is energized after precharging has ended (applies only to AC units equipped with bypass contactor).

Significance
- A bypass contactor (option) can be energized with the appropriate wiring and parameterization.

Bit 30: Message "Alarm sync. error" (H)

HIGH signal Alarm, "Synchronizing error" (A070)

Significance
- After successful synchronization, the phase deviation is greater than the parameterized tolerance range (P531).

Prerequisite TSY (option) available and P100 (open-loop/closed-loop control type) = 2 (V/f characteristic for textile applications) or P100 = 1, 2, 3 at line synchronism (P534 = 2).

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 31: Message "Pre-charging active" (H)

HIGH signal PRE-CHARGING (010) condition

Significance
- Pre-charging is realized after an ON command.