

**CiA 303**



***Recommendation***

Part 3: Indicator specification

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## HISTORY

Date	Changes
2001-07-01	<i>Publication of version 1.0 as draft recommendation</i>
2005-01-01	<i>Publication of version 1.2 as draft recommendation</i>
2006-08-14	<i>Publication of version 1.3 as draft recommendation</i> <i>- minor editorial changes</i>

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## 1 Scope

A common behavior of indicators helps service personnel to identify communication problems quickly without checking manuals for each device. This recommendation intends to specify the implementation of status LEDs (Light Emitting Diode) on CANopen devices.

This recommendation only describes the communication-related indicators. Additional application-related indicators can be present. Their use is either described in the appropriate device profile or is manufacturer specific.

## 2 References

/CiA301/      CiA DS 301, CANopen application layer and communication profile

## 3 Abbreviations and definitions

### 3.1 Abbreviations

LED    Light emitting diode

ERR    Error

I/O    Input/output

### 3.2 Definitions

#### 3.2.1 General

The definitions given in /CiA301/ apply to this draft recommendation too. As the manufacturer is free to use one bicolor LED or two single LEDs, the corresponding of the two following definitions shall apply.

#### 3.2.2 Using two CANopen LEDs

In case of using two single CANopen LEDs, the following definitions shall apply:

One LED shall be red and shall be labeled as ERR LED. This LED shall be called the error LED

The other LED shall be green and shall be called and labeled as RUN LED.

#### 3.2.3 Using one bicolor CANopen LED

In case of using one bicolor CANopen LED the following definitions shall apply:

The colors provided by the LED shall be red and green

The LED shall be labeled as STATUS LED

## 4 Indicators

### 4.1 Introduction

It is either recommended to support two single CANopen LEDs or one bicolor LED. Additional LEDs for power indication, I/O functionality etc. may also exist.

## 4.2 Indicator states and flash rates

The following indicator states are defined:

LED on	The LED shall be constantly on.
LED off	The LED shall be constantly off.
LED flickering	shall indicate the iso-phase on and off with a frequency of approximately 10 Hz: on for approximately 50 ms and off for approximately 50 ms.
LED blinking	shall indicate the iso-phase on and off with a frequency of approximately 2,5 Hz: on for approximately 200 ms followed by off for approximately 200 ms.
LED single flash	shall indicate one short flash (approximately 200 ms) followed by a long off phase (approximately 1000 ms).
LED double flash	shall indicate a sequence of two short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).
LED triple flash	shall indicate a sequence of three short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).
LED quadruple flash	shall indicate a sequence of four short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).

Figure 1 shows the indicator states and flash rates.

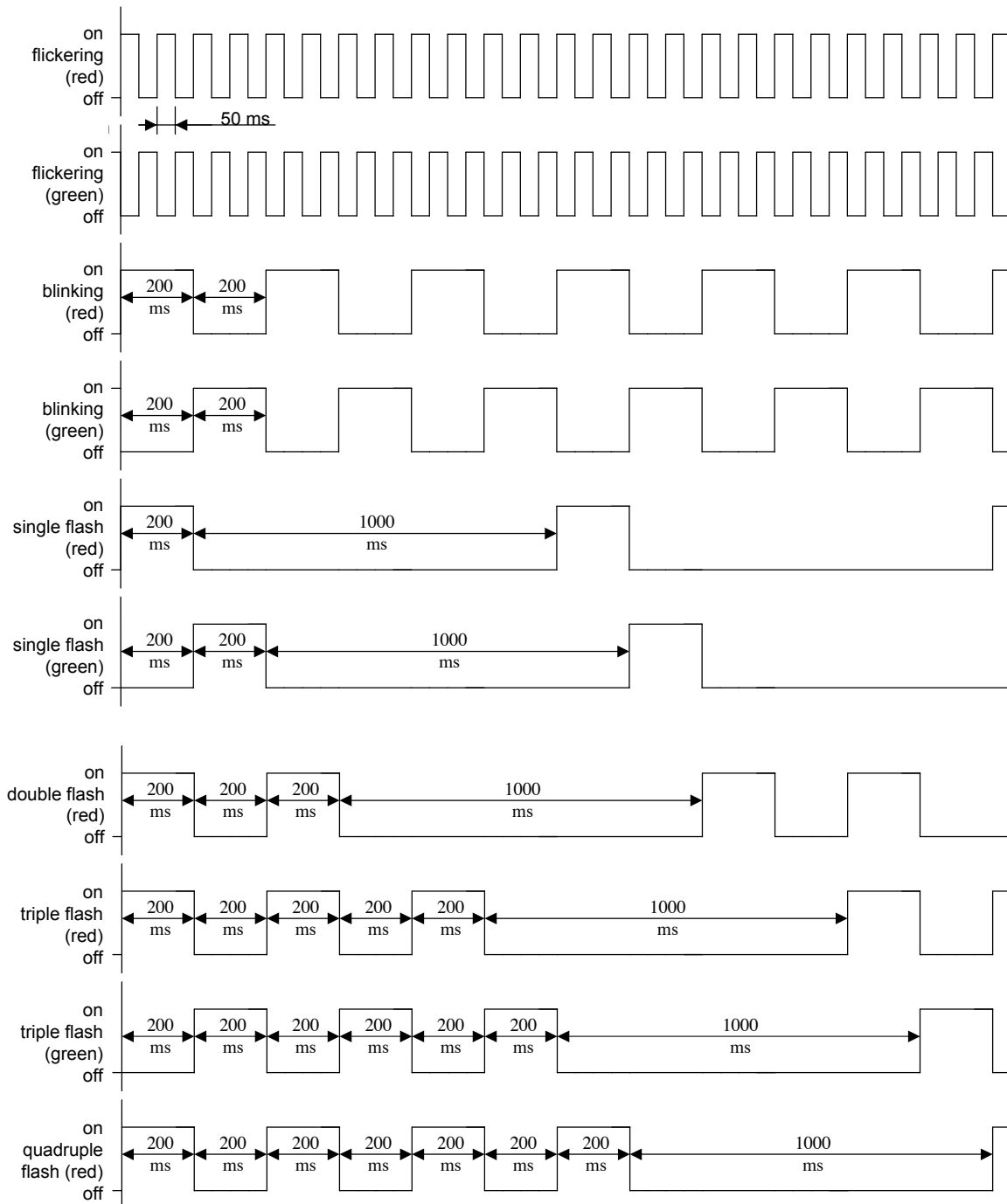


Figure 1 – Indicator states and flash rates

### 4.3 CANopen error LED

The CANopen error LED shall indicate the status of the CAN physical layer and errors due to missing CAN messages (sync, guard or heartbeat). If at a given time several errors are present, the error with the highest number shall be indicated (e.g. if NMT error and sync error occur, the sync error is indicated).

Table 1 shows the CANopen error LED truth table.

**Table 1 – CANopen error LED truth table**

ERR LED	State	Description	Category
Off	No error	The device is in working condition	Mandatory
Flickering	AutoBitrate/ LSS	The auto-bitrate detection is in progress or LSS services are in progress (alternately flickering with run LED) <sup>1</sup>	Optional
Blinking	Invalid Configuration	General configuration error	Optional
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)	Mandatory
Double flash	Error control event	A guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer) has occurred	Mandatory
Triple flash	Sync error	The sync message has not been received within the configured communication cycle period time out (see object dictionary entry 1006 <sub>h</sub> )	Conditional; Mandatory if object 1006 <sub>h</sub> is supported
Quadruple flash	Event-timer error	An expected PDO has not been received before the event-timer elapsed	Optional
On	Bus off	The CAN controller is bus off	Mandatory

#### 4.4 CANopen run LED

The CANopen run LED shall indicate the status of the CANopen network state machine. Whilst the device is executing a reset the CANopen run LED shall be off.

Table 2 shows the CANopen Run LED truth table.

**Table 2 – CANopen Run LED truth table**

CAN Run LED	State	Description	Category
Flickering	AutoBitrate/LSS	The auto-bitrate detection is in progress or LSS services are in progress (alternately flickering with error LED)	Optional
Blinking	PRE-OPERATIONAL	The device is in state PRE-OPERATIONAL	Mandatory
Single flash	STOPPED	The device is in state STOPPED	Mandatory
Double flash		Reserved for further use	
Triple flash	Program/ Firmware download	A software download is running on the device	Optional
On	OPERATIONAL	The device is in state OPERATIONAL	Mandatory

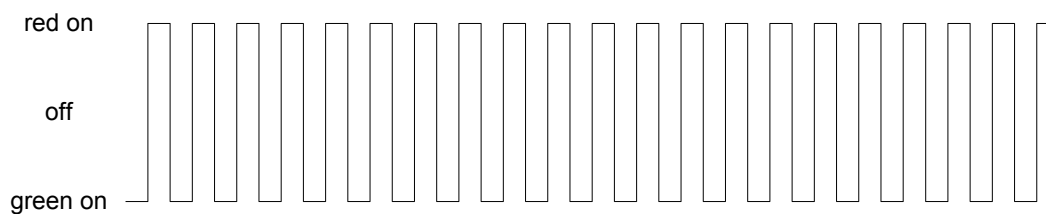
#### 4.5 CANopen status LED

If one bicolor status LED is used instead of two single color LEDs, this LED shall indicate both the physical bus status and the status of the CANopen state machine.

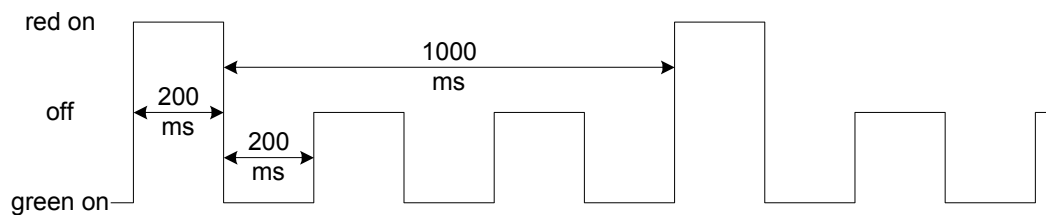
In case there is a conflict between turning the LED on green versus red, the LED may be turned on red. Apart from this situation, the bicolor status LED shall combine the behavior of the CAN error LED and those of the CAN run LED.

Figure 2 and Figure 3 show the examples for behavior of bicolor CANopen status LED:

<sup>1</sup> An LSS master shall flicker its ERROR and RUN LED whilst executing LSS services.



**Figure 2 – Flickering green/red: Auto-bitrate/LSS**



**Figure 3 – Single flash red combined with blinking green: “CAN warning limit reached” during pre-operational state.**