Tode-RC

Users Guide

Setup and Operation

TGit-Tech

Innovation run amuck

1. Contents

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2. Introduction

✔ The Tode Project is a Universal Platform of...

○ User Inter-Face Options
○ Back-plane Models optional Radio & Arduino Micro-Controller
○ Extensions - IO Interfaces, Battery Trays

The Tode System is licensed under the MIT License.
It's hosted on Github.com at: https://github.com/TGit-Tech/Tode-RC
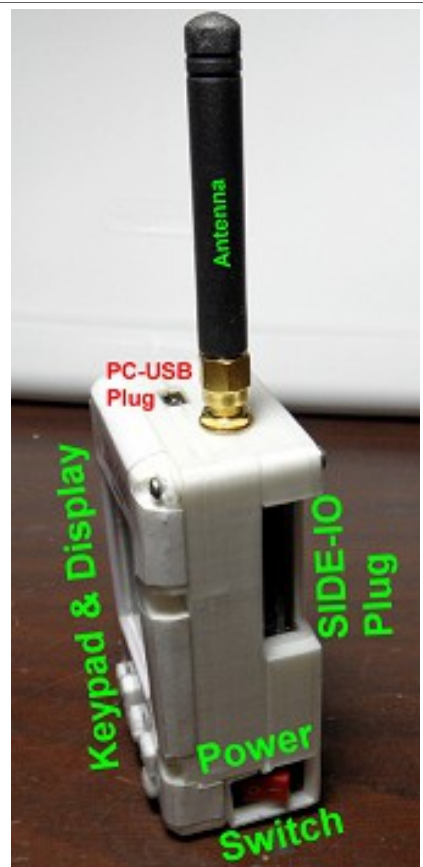
2.1 Specifications

✔ Remote-Control Tested Distance
- ○ Test Setup
  - ▪ (2) Todes set at Tx Power 30dbm
  - ▪ (2) Todes having a 5dbi 20cm Omni antenna
  - ▪ Stationary Tode antenna mounted 12ft above ground level
  - ▪ Rural Area.
- ○ Signal can reasonably be used at 2-miles away
- ○ Signal can be spot gotten (hard to get) at 3-miles away
- ○ There is no signal past 3-miles

2.2 Menu Structure

✔ Multiple Todes make-up a remote-control network-of Individual Todes.

  ○ The particular Tode in subject is self-described as **This-Tode**.
  ○ Each Tode that is accessible on **This-Tode** has its own Tode-Screen.
    ▪ Tode-Screen are ordered Horizontally
      ▫ Left-most = This-Tode (use ⬅ button to switch left)
      ▫ Right-most = Last Remote-Tode accessible (use ➡ button)

Power-On 1st Screen **This-Todes Tode-Screen**	Press Right ➡ on This-Todes Tode-Screen Goes to 2nd,3rd, etc.... **Remote Tode-Screens** *On Initial Power-ON nothing changes because there are NO other Remote Todes added at this Time.*	Press SET on This-Todes Tode-Screen Goes to This-Todes Setup-Screen

✔ **Sub-Level Menu** Screens (*From This-Todes* **SETUP** *Screen*)
  ○ Selecting **Radio** and GET will produce Sub-Level Radio Settings.
  ○ Selecting **Add Device** and GET will produce Add a Device Screen.
  ○ Selecting **Del Tode** and GET will produce List of Todes.
  ○ To Exit a Sub-Level Screen press the ⬅ button.

3. Configure

3.1 Set Name

1. Enter a Name for **This-Tode**

On SETUP Screen	SETUP, 'Set Name'	SETUP,'Set Name'
Press ⬇ to the blank [NAME] field. Press **SET**	On 'Set Name' Screen Press ⬇	*Text Entry Field* highlights (Blue)

Text Entry Field is <u>Red</u> when not selected else <u>Blue</u> when Selected by ⬇⬆.
Once Selected (BLUE) Character Position (WHITE) can be Selected by ⬅➡

SETUP 'Set Name' *Entering a Name*	SETUP 'Set Name' *Saving & Exiting*	SETUP

To Edit or Clear a Character Position; Highlight the Text Field (BLUE) and
select the character to replace (WHITE) then choose the replacement
character press SET. The BLANK character is directly under the "EXIT".

3.2 Radio Settings

3.2.1 Requirements

✔ Radio Settings that **must be identical** for Tode Communication.

SecNet	Security Code selected by you that prevents unauthorized
(Range 01-7F)	access to your Tode network.
Frequency	The radio frequency (channel) for Tode Communication.
(410 to 441)MHz	

✔ Radio Setting that **must be Unique**

Address	A radio address to identify each Tode uniquely decided
(Range 0000-FFFE)	upon by you.

✔ Other Radio Settings

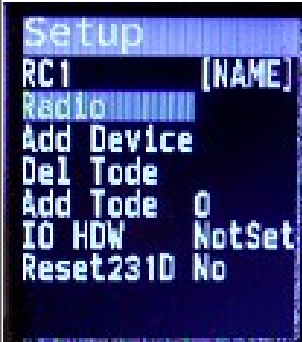|	
Tx Power	Sets the (Tx) Transmitting Power of the Radio.
(21,24,27,30)dBm	Lower saves power, Higher transmits farther.
PC Connex	When set to On it ties the radio terminal to the USB Port.
(On -or- Off)	This a special function generally ignored by users.

3.2.2 Per-Digit Setting

1. Choose any **SecNet** Value between 01 to 7F and Set that Value.

SETUP	SETUP RADIO	SETUP RADIO (Per-Digit Set)
⬇ to select **Radio**. Press Ⓖ	⬇ to select **SecNet** ⮕ to select **Value**	Press SET to change. Press SET again to set.

SecNet and **Address** use Per-Digit Set where each digit is changed at a time. The WHITE background indicates the selected digit. Use ⬅➡ to change the selected digit and ⬆⬇ to change the digits value. Going ⬅ beyond the number of select-able digits will exit setting without saving changes.

2. Choose any ***Unique*** Address Value for this Tode between 0001 and FFFE and set that Value the same way <u>Per-Digit Set</u> as done to set SecNet.
   - In this example Address is set to 1112.

3.2.3 Value Setting

3. Choose any **Frequency** between 410MHz and 441MHz (default is 433MHz).
   ○ The chosen frequency must be identical on all Todes expected to communicate with each other.

SETUP RADIO	SETUP RADIO	SETUP RADIO (Value Set)
⬇ to **Frequency**	⬄ to select **Value**	Press SET to change.
Radio SecNet 12 Address 1112 Frequency 433 Tx Power 21dBm PC Connex Off	Radio SecNet 12 Address 1112 Frequency 433 Tx Power 21dBm PC Connex Off	Radio SecNet 12 Address 1112 Frequency 433 Tx Power 21dBm PC Connex Off
⬆ to Increment Value ⬇ to Decrement Value	Press SET to save Value. ⬅ to **Frequency**	⬅ again to **SETUP**
Radio SecNet 12 Address 1112 Frequency 434 Tx Power 21dBm PC Connex Off	Radio SecNet 12 Address 1112 Frequency 434 Tx Power 21dBm PC Connex Off	Setup RC1 [NAME] Radio Add Device Del Tode Add Tode 0 IO HDW SideIO Reset231D No

4. Choose the lowest **Tx Power** level that will sustain communications.

3.3 IO HDW Setting

1. A Tode that has connected devices must know what **IO HDW** is used to connect the devices. If the Tode will be used only as a hand-held control device, then setting the **IO HDW** is not needed.

   a) At the time of this writing the only option for connecting devices is a **SideIO** Plug (SIOST stands for SideIO with Screw Terminals).
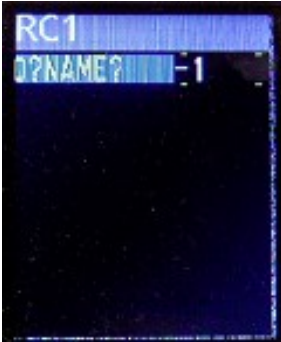
SETUP	SETUP	SETUP
⬇ to **IO HDW**	➡ to select **Value** (I.e. 'NotSet' in picture)	SET then ⬆ or ⬇ select **SideIO** SET to set the value

2. **NOTICE**: If the **IO HDW** has not been set before trying to set a device **PIN** the Tode will notify you with **SetHDW** as shown below.

3.4 Adding Devices

See 5.1 Section for more information on Device Support and Setup.

SETUP	SETUP Add Device	This-Tode
⇧ or ⇩ select **Add Device** Press Ⓖ	⇧ or ⇩ Select Device to Add. Press Ⓖ	The added device appears as **?NAME?** *0 is the Device Index #*
Setup RC1 [NAME] Radio Devices Todes Add Device Add Tode 0 IO HDW SideIO Reset21BH No	Add Device OnOff AnaInput AnaOutput Distance STSTP3W SetPoint Math	RC1 0?NAME? -1

This-Tode Select Device	Selected Device SET=Device Set Name	Selected Device Ⓖ=Device Setup
⇩ select 0?NAME?	Press SET enter Set Name for the Device. *Same routine as setting a Tode name.*	Re-Select Device. Press Ⓖ enter Setup *Enter Device specific Setup Settings (Ex. Only)*
RC1 0?NAME? -1	Set Name RELAY1 EXIT SAVE !"#$%&'()*+,- ./0123456789:: <=>?@ABCDEFGHI JKLMNOPQRSTUVW XYZ[\]^ `abcde fghijklmnopqrs tuvwxyz{|}~	OnOff Setu Pin 33 pinMode OLoOff Del Device
		Note: OLoOff Output Low, when Off

3.5 Device Control

Below shows an example of how to change an Output Device's State.

This can be done on LOCAL (This-Tode) devices or devices on Remote Todes.
To add a Remote Tode see 3.6.Add Tode (Remote)
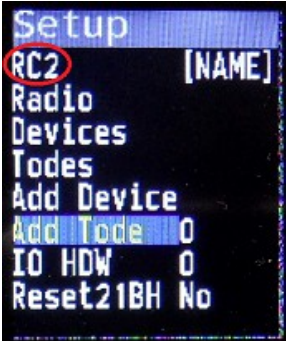
NOTE: Remote Tode Devices will show a value of '?' until the readings are
requesting by pressing (GET).

This-Tode	This-Tode	This-Tode
⬇ select **RELAY1** ➡ to select **Value** <u>Value</u> 'Off' Press SET|	SET to set a new value. ⬆⬇ change **Value** SET to set the value	Once set to 'On' Relay1 on pin 33 should activate.

3.6 Add Tode (Remote)

✔ To Remotely Control another Todes Devices.
  ○ The "Remote" Tode (RC1 with RELAY1:IO-Device used this far)
  ○ is added to a new Tode (RC2)

✔ Obtain a 2nd Tode
  ○ Repeat Steps 3.1.Set Name and Name the 2nd Tode **RC2**
  ○ Assign a *Unique* Radio Address to RC2

RC2 Radio Settings	Required	RC1 Radio Settings
Radio SecNet 12 Address 2222 Frequency 433 Tx Power 21dBm PC Connex Off	**SecNet** has to Match. **Address** must be different / unique. **Frequency** has to Match.	Radio SecNet 12 Address 1112 Frequency 433 Tx Power 21dBm PC Connex Off
On Tode RC2		
⬇ select **Add Tode**	add **RC1** by **Address** ➡ to select **Value** SET to set RC1-Address	Check for an **RC1** "remote" Tode Screen. SET Again to load RC1 ➡ RC1 remote Screen
Setup RC2 [NAME] Radio Devices Todes Add Device Add Tode 0 IO HDW 0 Reset21BH No	Setup RC2 [NAME] Radio Add Device Del Tode Add Tode 1112 IO HDW SideIO Reset231D No	RC1xc RELAY1 ?
Now the Devices on RC1 can be controlled by RC2. If the "remote" Tode RC1 failed to show up; try again closer to the unit.		

3.7 Deleting

3.7.1 Deleting Devices

To Delete a Device enter the Device Setup Screen as shown in 3.4.Adding Devices and select **Del Device** and press GET.

3.7.2 Deleting Remote Todes

To Delete a Remote Tode control screen. Select **Del Tode** on the SETUP menu and then select the Remote Tode by Name on the list and press GET.

3.7.3 Factory Reset

Preforming a factory reset deletes the Tode Name and all Devices and Remote Todes. Radio Setting are preserved. To preform this operation...

⬇ select **Reset????** **Note:** The 4-Digit after Reset is the Firmware Version Loaded. Firmware 231D	➡ **to** select **Value** SET to set ⬇ to set **Yes** SET again to apply.	The Tode will automatically Reboot and the blank Tode screen will show.
![Setup screen with Reset231D No highlighted]	![Setup screen with Reset231D Yes highlighted]	![Blank Tode screen]

4. IO Devices

4.1 Common Settings

✔ Every Device Setup has a **Del Device** option.

✔ Every **Pin** has a corresponding **pinMode** option.
  ○ **OLoOff** = Output Low, when Off – Active High
  ○ **OHiOff** = Output High, when Off – Active Low
  ○ **InHigh** = Input Pull-Up(High) – Active Low
  ○ **InLow** = Input Low – Active High (Default Setting)

4.2 OnOff

On Off Device Setup Screen	
Pin	Can be any Pin Selectable
pinMode	ptions in #4.1.Common Settings
Del Device	Select and (GET) to delete this device

4.3 AnaInput

The equation for Value = (Pin-Reading + PreAdd) * (MultNum/MultDen) + Add.
MultDen cannot be 0 so 0 equivocates to 10K (10,000)

On Off Device Setup Screen	
Pin	The Pin to read from (must be an 'A' pin)
pinMode	
PreAdd	1st Add this amount to the Pin reading.
MultNum	2nd Multiply by fraction (Fraction Numerator)
MultDen	(Fraction Denominator)
Add	3rd Add after fraction multiply (i.e. offset value)
Samples	Number of reading to gather and average for value.

4.4 AnaOutput

AnaOutput is the PWM output operation	
Pin	Analog Output is Always on PIN #45

4.5 Distance

This is used for Sonic Distance Sensors with a Trigger & Echo Pins.

Distance Device Setup Screen	
Trig	The Trigger Pin
	The Trigger Pins pinMode
Echo	The Echo Pin
EchoPMode	Echo Pins pinMode
Samples	Number of Samples to Average for Value

4.6 STSTP3W

This is used for panels with a START and STOP momentary push buttons.
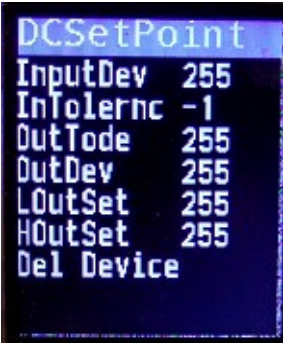
3-Wire On/Off Momentary (3-second) Switch	
StartPin	OUTPUT hat triggers to initiate a START button.
StartPMode	StartPin pinMode Setting
StopPin	The Pin that triggers to initiate a STOP button.
StopPMode	StopPin pinMode Setting
Status	INPUT; Pin that determines current state.
StatPMode	Status Pins pinMode
Del Device	Select and (GET) to delete this device

5. Automation (Logic)

5.1 SetPoint

Compares an Input Device reading to a User SetPoint and if the Input reading is outside the boundaries (+/- Tolerance) then it sets an Output Device respectively.

For example; A tank of water with a level sensor can maintain it's water level by switching ON or OFF a pump that feeds the tank.

On Off Device Setup Screen	
InputDev	The Device Index to read a value from
InTolernc	The (+/-) tolerance allowed from setpoint
OutTode	The Tode Index of Out Device (optional) or 0-local
OutDev	The Device Index to SET the value on (optional)
LOutSet	SET value on OutDev when Input is < setpoint
HOutSet	SET value on OutDev when Input is > setpoint
	SET value can be ON or OFF
	Or INCR/DECR where Difference between setpoint

Implements Mathematical Operation on TWO input readings and (Optionally) sends the computed value to an output device if the value breaks tolerance (+/-) boundaries (i.e. Value changes significantly).

On Off Device Setup Screen	
In1Dev	The Device Index to read a value from
Operator	(+)(-)(x)(/) plus, minus, times, divide or AVE-average
In2Dev	The Device Index to read a value from
Tolerenc	+/- Change Tolerance before setting Output
OutTode	The Tode Index of Out Device (optional) or 0-local
OutDev	The Device Index to SET the value on (optional)

Note: When OutTode is a Remote Tode; values are only sent every 14s when the In-Value passes +/- Tolerance of the last sent value.

6. System

The System menu allows one to do factory resets, enable MQTT, Soft Reset the unit and lookup the firmware version loaded. Pressing the Okay button on the FWver-???? entry causes the Soft Reset.

System Sub-menu	
USBSerial	What the Top USB plug is used for (auto-reboots)
Factry RST	Factory Reset
Pub ADiscv	Publish homie MQTT data for Auto-Discovery
SRFWv-????	Soft Reset. Displays current Firmware verson.

- ✔ **USBSerial** allows (3)options
  - ○ *NOTICE: Changing the USB-Serial use causes an auto-reboot to occur.*
    - ▪ **None** = There is no USB Serial Usage (option for debugging)
    - ▪ **MQTT** = Tode uses USB Serial to communicate with MQTT Server.
    - ▪ **KBC** = Keyboard Control by Serial Input. (For Automated Testing)
      - ▫ 8=up   9=Set
      - ▫ 4=left, 6=right
      - ▫ 2=down   3=Get

- ✔ **Factry RST** erases all Todes and Devices and User-Settings.

- ✔ **Pub ADiscv** publishes 'homie' auto-discovery MQTT on-demand.
  - ○ only works when USBSerial=MQTT.

- ✔ **SRFWv** preforms a soft (no-erase) reset on-demand and also displays the loaded firmware version. It can be used to reset without power-cycling after making a new setting for USBSerial or any reason to do just a soft-reset.

7. MQTT Control

Tode-RC firmware ver.232D+ has support for 'homieMQTT' Internet of Things(IoT) control using the Serial plug to connect a Tode to a Raspberry Pi IoT server.

7.1 Tode Setup

In SETUP→System→USBSerial set to 'MQTT'.
See 6.System for details.

7.2 OpenHab Server Setup

7.2.1 Openhabian

Download Raspberry-Pi Imager at https://www.raspberrypi.com/software/

When you run it; It'll ask for...
  1. Operating System: scroll down and click "Other specific-purpose OS"
     ○ Pick & Click "Home assistants and home automation"
     ○ Pick & Click "openHAB"
         • Pick 32-bit as OpenHAB states use 32-bit; works best.
         • Storage: Choose the Flash-Card Target.

  2. Insert Card into Raspberry-Pi and attach an Ethernet Cable
     ○ Power the Raspberry Pi and wait a while for boot up process.
     ○ Connect to the openHAB UI at http://openhabian:8080

- ○ This may take up to 45-Minutes to become available
- ○ May have to use MS-DOS">arp -a" command to find it's IP-Address
- ○ Enter an administrator Username and Password on Startup.
- ○ Connect to the openHAB Log Viewer (frontail): http://openhabian:9001

7.2.2 Putty

3. Install PuttySSH Terminal on a Home PC.
   a) See: https://putty.org/

   b) Run the Putty terminal
      - Click on Connection Type: **SSH**
      - Enter Host Name: **openhabian**
      - click **open**.

   c) Login
      - Username: openhabian
      - Password: openhabian

7.2.3 MQTT Broker & Client

1. Login to the Server computer (Raspberry Pi) using 'Putty' terminal.

   a) Install the MQTT Broker (Mosquitto) on the Raspberry Pi.
      - See: https://community.openhab.org/t/oh3-mqtt-setup-and-configuration/111494
      ```
      openhabian:~$ sudo apt install mosquitto
      openhabian:~$ sudo systemctl start mosquitto
      openhabian:~$ sudo systemctl daemon-reload
      openhabian:~$ sudo systemctl enable mosquitto
      ```

   b) Also install MQTT Client (mosquitto-clients) on the Raspberry Pi.
      ```
      Openhabian:~$ sudo apt-get install mosquitto-clients
      ```

   c) Visit the above link for enabling outside IP connections if desired.

2. Test the MQTT broker setup with mosquitto-clients.

   a) Login with a 2nd putty terminal and enter

```
openhabian:~$ mosquitto_sub -v -t 'test/topic'
```
   b) On the 1st putty terminal send an MQTT publish
```
openhabian:~$ mosquitto_pub -t 'test/topic' -m 'helloWorld'
```

verify that the (-m)message 'helloWorld' appears on the 2nd terminal.

✔ Online Instructions for installing an MQTT broker on Raspberry Pi.
   ○ https://www.openhab.org/addons/bindings/mqtt/

7.2.4 Serial2MQTT

1. Install serial2mqtt
   ○ See: https://github.com/TGit-Tech/Tode-RC-
     Firmware/tree/main/serial2mqtt_build
```
openhabian:~$ wget https://raw.githubusercontent.com/TGit-
Tech/Tode-RC-
Firmware/main/serial2mqtt_build/serial2mqtt.`arch`.zip

openhabian:~$ wget https://raw.githubusercontent.com/TGit-
Tech/Tode-RC-Firmware/main/serial2mqtt_build/serial2mqtt.json

openhabian:~$ unzip serial2mqtt.`arch`.zip
openhabian:~$ mv Debug/serial2mqtt.`arch`  serial2mqtt
```

2. Setup crontab to auto-run serial2mqtt at start-up
   ○ Start the crontab editor
```
openhabian:~$ crontab -e
```
   ○ Edit the file adding the following line at the bottom of the file.
```
@reboot /home/openhabian/serial2mqtt
```

  be sure to save / write changes to file.

3. Check operation
   a) Reboot (Power-Cycle) the Raspberry Pi Server.

   b) Make sure 'serial2mqtt' starts after Raspberry Pi reboot
```
openhabian:~$ ps -x
  PID TTY       STAT    TIME COMMAND
  347 ?         Ss      0:00 /bin/sh -c /home/openhabian/serial2mqtt
  348 ?         Sl      0:01 /home/openhabian/serial2mqtt
```

   c) View the 'serial2mqtt' logfile
```
openhabian:~$ tail -f log.serial2mqtt.0.log
```

d) For debugging; you can launch 'serial2mqtt' from the command line.

```
openhabian:~$ ~/serial2mqtt
```

e) Attach Tode to the Raspberry Pi by USB cable.
   • Watch the 'serial2mqtt' log file as it connects and publishes data.

7.2.5 OpenHab

Inside OpenHab you can now add the MQTT binding which also requires an MQTT thing. Once the Tode publishes it's 'homie' MQTT data the first time a 'tode' thing will show up in the 'inbox' feature.

However; due to OpenHab bugs after a 'tode' thing has been added one must instruct the Tode to send the 'homie' data a second time. Go to Todes SETUP menu, to 'System' menu and select 'Pub ADiscv' (stands for Publish Auto-Discovery data) and push the Okay button.

Only after OpenHab has received the 'homie' data a second time will the 'channels' show up. The rest of OpenHab setup should be instructed in the OpenHab guide.

The Tode publishes MQTT in the form of homie/tode/todename/devicename (gets) + /set for (sets).

It also publishes MQTT in the form of homie/tode/tstodename/tsdevicename where the 'ts' prefix stands for timestamped status. 'ts' channels are for (gets) only and appends a hexadecimal millisecond timestamp to the gotten value. (example; ON-2fe3a1). Using OpenHab label card to show this (gotten) value ensures that the sets are preformed correctly. Watch that the timestamp changes after setting a new value.

A. MQTT /get Value Update

Once Widgets are setup to turn things on and off.
Using a Label Card to display "ts" values.

1. Get the UID of the MQTT Broker by clicking the 'Copy UID' symbol.

2 things

Alphabetical	By binding

M

MQTT Broker [Copy UID]   ONLINE ›
mqtt:broker:58b97f2f4b 📋

T

tode   ERROR: COMM ›
mqtt:homie300:58b97f2f4b:tode 📋

2. Create New script named mqttGet
    a) Use 'ECMAScript'
    b) actions.get("mqtt","mqtt:broker:58b97f2f4b").publishMQTT("homie/tode /1com6/get","")
    c) Paste your MQTT Broker UID in second get() parameter. And adjust the publish MQTT for the 'TodeName' for the /get.
3. Setup the Label Widget to run the 'GetScript' when clicked.
    a) Under Action choose 'Run rule'
    b) Click Rule and select 'mqttGet' for the 'script name'.

ID   overview

←   **Edit Label Card**   Done

Footer of the card

Action
Action to perform when the element is clicked

Action   Run rule ›
Type of action to perform

Rule   mqttGET ›
Rule to run

Rule Context   [] Edit script
Object representing the optional context to pass to the rule. Edit in YAML or provide a JSON object, e.g. { "param1": "value1", "param2": { "subkey1": "testing", "subkey2": 123 } }.

Label
Parameters of the label

≔   **Item**   tsonoffa3 (tode_tsonoffa3) ›
Item to display

Label

Display this text (or expression result) instead of the item's state