

## Omron TMFlow 1.84

Spotlight Webinar Adrian Choy, 11/17/21

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#### Spotlight Webinar

- TMFlow Overview
- Major Feature Summary
- Hardware Upgrades and Accessories
  - Hardware Accessories
  - Hardware Upgrade Kits
  - Fieldbus Functionality (EIP & Profinet)
- References / Training Resources

#### **TMFlow Overview**

- TMFlow is developed by Techman
- TMFlow is preinstalled on Omron TM cobots
- TMFlow is free, but various licensed options are available for added functionality
- Existing collaborative robots can be updated to new versions of TMFlow (if hardware requirements are met)





#### Simple Drag & Drop Programming



#### **TMFlow Overview**

- Visual based programing
- Each function provides easy to follow parameter setups
- Create logic without script programming
- Intuitively follow the process and logic flow





#### Hands on interactive teaching

- Users can physically move the robot and "teach" the robot positions and vision tasks using wrist-mounted buttons
- TMFlow adds nodes to program as users teach the steps.
- Once teaching is complete, users can configure the parameters of each node created during hand-guidance teaching
- Hands-on programming is intuitive for non-programmers

#### Safety Advantage

Omron TM cobots provide customers with a guided safety setup process.

#### Based on ISO/TS 15066

This does NOT eliminate the need for a safety assessment but it can greatly reduce the cost and testing process.

Competitors do not have this in their software or manuals so customers are on their own.

# Step

#### **Safety Setting**

4

=



#### Step 2

#### 4 $\equiv$

#### **Safety Setting**

Performance Safety	Body Region	Risk Setting	X More Limit Sett	ing X		
June Marking Color	ТСР					
Human - Machine Safety Settings	TCP Speed	0.200000	00079 m/sec			
Safety IO Settings	1		ingeet			
	TCP Force	130	Ν			
Cartesian Limit	Joint Speed		Jo	int Torqu		
	J1:	190	deg/sec	J1:	65	Nm
	J2:	190	deg/sec	J2:	65	Nm
	J3:	190	deg/sec	J3:	65	Nm
Default	J4:	235	deg/sec	J4:	15	Nm
Save	J5:	235	deg/sec	J5:	15	Nm
Last Modified:						
2019-11-27T06:32:03+08:00	J6:	235	deg/sec	J6:	15	Nm

### Plug & Play Ecosystem

The Plug & Play Ecosystem provides pre-programed and configured controls for 3<sup>rd</sup> party grippers, force sensors, external cameras, and more

Drag & Drop the icon into your program and the is device ready to be used



Gripper Button

#### Software

- ✓ No more protocol reading!
- ✓ Error Handling nodes Included

✓ Gripper Button – One Click for Grip/Release

Hardware

✓ Hardware Flange/Wiring Ready to Connect

#### TMFlow Licenses

- Most customers will only need the free software
- TMFlow Editor is recommended for customers with multiple units and applications

Name	Туре	Part #	Description
TMflow	installed in robot		UI for control box when you use screen/keyboard/mouse directly
TMflow Client	Free download		UI for using tablet/laptop to connect to control box through TCP/IP
TMflow Offline Editor	Dongle License	RT6-S200001 Requires Dongle	<ul> <li>Create/Open/Edit flow files Offline</li> <li>Program all the flow then output to the robot for recording points/teach vision jobs.</li> <li>No robot simulation</li> </ul>

#### **Optional Software**

 Additional licenses are available to expand the capabilities of the integrated vision system as well as offline editing

 Licenses can only be loaded onto dongles by the factory

 Multiple licenses can be loaded onto a single dongle

Name	Туре	Part #	Description
TM EXTERNAL	Dongle	RT6-S100002	<ul> <li>Activate the permission to use external cameras</li> <li>Activate external camera software functions.         <ul> <li>✓ Upward looking jobs</li> <li>✓ Eye to hand jobs</li> </ul> </li> </ul>
VISION	License	Requires Dongle	
TM IDENTIFY &	Dongle	RT6-S100000	Activate identify & measure software functions.
MEASURE	License	Requires Dongle	(both eye in hand & eye to hand)
TM OCR	Dongle	RT6-S100003	Activate OCR software functions.
	License	Requires Dongle	(both eye in hand & eye to hand)
TMflow Editor:	Dongle	RT6-S100005	<ul> <li>Activate offline AOI functions of TMflow</li> <li>Editor</li> <li>Can open AOI jobs from real robot</li></ul>
Offline AOI	License	Requires Dongle	project to modify and save in TMflow <li>Editor.</li>



## **TMFlow Feature Updates**

Major feature additions and changes from versions 1.76 to 1.84

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## TMFlow Compatability

- Version 1.76+ requires at least HW ver. 3.0
- Robots with HW ver.
   3.2 MUST run at TMFlow ver. 1.76 or above



#### TMFlow 1.80: Node Error Highlighting

#### In Manual Mode

- 1. Returns to **Project** Editing Page
- 2. Highlights the node that induced the error
- 3. Expands the system log with the error code
- The system will only expand the system log with the error code if there is no account logged in or the current user doesn't have the authority to open the project.

Node "P2" is highlighted in green due to an error and its corresponding error is displayed in the rightside log when the error occurs during Manual Mode

Step Run Diagnosis Point Manager	Base Manager Controller	Variables	Clear Stop
Tests_MarcModolell	ži 21 91 <	> 🔻	
		, do	Common Info General information
Start P1			15:45:02 0x0004F000 Continue_EDIT_Project \Projects\Tests_MarcModolell\Tests_MarcModolel 15:45:02 0x0004F000 J6 Torque limit value is 15 15:45:02 0x0000FF17 [R0][Error][Safety Function]J6 Torque exceeds lim 15:45:02 0x0004F000 Edit Project Edit 15:45:02 0x0004F000 STOP Project 15:45:02 0x0004F000 STOP Project handling
			15:45:02 0x0004F000 STOP Project 15:45:02 0x0004F000 STOP at P2 at Te_ts_MarcModolell 15:45:02 0x0004F000 STOP Project handling 15:44:59 0x0004F000 Run Project \Projects\Tests_MarcModolell\Tests_MarcModolel 15:44:54 0x0004F000 Leave Editing Project
	1009		15:44:46 0x0004F000 FreeBot Finished

#### TMFlow 1.80: Node Error Highlighting

#### In Auto Mode

- System log will expand users will be allowed to view the Flow
- Users can click Flow to generate the project flow with the node that induced the error highlighted. If the flow did not induce the error, the highlight is on the last executed node.

The Node "P2" error is displayed in the rightside log when the error occurs during Auto Mode

Display Board F	ow IO	Simulator	Status	Actioner	Force Sensor	Tests_MarcModolel	Clear Stop	
						{X} Variables	Detail Common Info General information	Х
	C						15:47:07 0x0000FF17 [R0][Error][Safety Function]J6 Torqu 15:47:07 0x0004F000 J6 Torque limit value is 15 15:47:07 0x0004F000 STOP Project	e exceeds ^
							15:47:07 0x0004F000 STOP Project handling 15:47:07 0x0004F000 STOP Project 15:47:07 0x0004F000 STOP at P2 at TCits MarcModolell	C.
Wait for 1st vision task	-						15:47:07 0x0004F000 STOP Project handling 15:47:01 0x0004F000 Run Project	MarcMod
Job Start Time		(					15:46:32 0x0004F000 Cancel Editing Project	_marcimou
Job Name							15:46:05 0x0004F000 Leave Editing Project 15:46:02 0x0004F000 Continue EDIT Project	
Job Execution 1	ime (ms)	0					\Projects\Tests_MarcModolell\Tests 15:46:01 0x0004F000 STOP Project	_MarcMod
Vision IO List Si	atus						15:46:01 0x0004F000 Edit Project Edit	
TMCam_AF02							15:46:01 0x0004F000 STOP Project	, . , .

## TMFlow 1.82: Programming Improvements

- The left side of the Expression Editor can now be edited after an expression has been added
- A "Stop Criteria" has been added to all logic nodes





## TMFlow 1.82: Performance Optimization

- Enable the busy loop optimization to lower the CPU loading. This helps prevent previously observed communication delays in TMFlow
- Useful if thread pages do not use a "WaitFor" node, and experience high CPU loading.

S	tart
Project S	Speed is 5%
Reset AO DO while	Project Initializing
Enable continuous	motion
💟 Enable busy loop o	ptimization

#### TMFlow 1.80: Manual Decision Node

- This node pauses the project and awaits for operator input
- A decision popup will appear when the project arrives at a decision node prompting a choice
- Popups can be customized
- Can set a timeout case in the event that no decision is made within a certain timeframe



Example of a Manual Decision Node Popup for a Barcode Reading task

#### **Vision Job Error**

The job has failed to detect barcode, please choose a route to continue your flow



N	fanual E	Decision Case	X
Node Name		MDecision1_S	case0
Index		0	
Font Color		White	~
Background C	Color	Blue	~
Digital I/O	IO(0)		>
Variables	Variab	les(0)	>
Analog I/O	AIO(0)		>
ок		Delete thi	s node

#### TMFlow 1.80: Loading Analysis

- Monitors torque of  $\bullet$ each movement node and color codes the node box outline
- Users can adjust  $\bullet$ motion settings based on these indicators to prevent potential joint damage and elongate lifespan of the robot
- Yellow for High Risk, Green for Low Risk, and Gray for Unknown

OMROF











1/0

Set IO while Project Error



Stop Watch

Project Stop F

Set IO while

Modbus

Apply been edited. Reducer anosis data is out of te project to update.

Joint Loading

Show Indicator

High Risk

Low Risk

Unknown

	Z↓Z↓ Θ↓
	P2 , testing
1	Path1 , testing

View Seria 5 Path Joint Loading Generate

	Project h loading c date. Exe	a: li
F/T Sensor		
•****•		F
Serial Port		

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#### Auto Remote Mode Icon



#### TMFlow 1.80: Auto Remote Mode

- New mode of operation for the cobot focused on control by external devices. When active, the cobot can only be controlled by external sources.
- Can be activated by entering Auto Mode and manually toggling Auto Remote Mode in TMFlow
   OR you can set the cobot to enter Auto Remote Mode upon boot up
- Care should be taken when upgrading applications with existing external control methods to v1.80+.
   Issues will occur unless the external control is translated to the Auto Remote Mode method



#### TMFlow 1.76: Path Node

- The Path node allows the user to import a .PATH file into TMFlow. .PATH files are a collection of points that are generated from a CAD file.
- RoboDK is the recommended software to use when generating .PATH files. It's a 3<sup>rd</sup> party, licensed software platform
- .PATH files are transferred onto the robot via a USB.
- Paths requiring constant TCP speed should utilize the Point Nodes in a point-to-point project instead

## TMFlow 1.76: Path Node

- The Path Node features a "Path Task" configuration menu.
- Analog and Digital Outputs can be toggled on and off at set points

$\leftarrow$	Path Task	
Task Name	I	0
Number of total poi Current Point: Not	nts: 354 on the path	
Target Point		0
Digital Out	IO(0)	>
Analog Out	AIO(0)	>
Move (+)	Speed	1.00 %
	Save	

## TMFlow 1.80: Hand-guided Path Recording

- Path recording while hand-guiding the robot is possible (10 min limit for a path)
- Motion record must be saved as a Path file to be an available option within the PATH Node
- Only able to generate a
   Free button robot
   motion record not able
   to use the jog mode
- Position sampling based
   constant speed
- Can be used in conjunction with a force sensor



#### **Motion Recording**



test

## TMFlow 1.82: Path Node and Motion Record

- Time settings enabled in path file generation
- Select either Position or Time data type sampling when generating a path
- Time Sampling may be preferred in applications where speed variation or halting is required along a path



## TMFlow 1.80: Controller Jog – F/T Sensor

- Able to use a F/T Sensor as the input for hand guided motion
- Must have free button pressed, then any linear or rotational force will guide the direction of the robot
- Able to also select the Joint settings for limitation of specific axis





#### TMFlow 1.80: Vision (Action) Viewer

- In the new Vision
   Viewer, operators can check images of the current vision job as a project is running.
- Users can pause the project and check all finished vision jobs in the meantime. This requires some form of image logging.
- Available in Manual Mode and Auto Mode



## TMFlow 1.80: Smart Pick

- Smart Pick uses the Landmark to achieve fast, fixed point vision jobs without the calibration plate
- Designed for applications where >2mm accuracy is acceptable



## TMFlow 1.80: Smart Pick

- Use the Landmark to achieve fast, fixed point vision jobs without the calibration plate
- Designed for low precision applications,
   2mm accuracy recommended



## TMFlow 1.80: External Classification & Detection

- New vision tools capable of sending images to a remote HTTP server, and receiving the processed results in JSON format
- When the vision job finishes, the External Detection module outputs the position and label of the detected object



## TMFlow 1.82: Select by Variable – Vision, Path

- Variables to select
   Vision Jobs and Paths
   programmatically
- If "Variable" is selected for Paths, "Data Type" and "Direction" will be fixed to "Position" and "Forward"
- "Point Management" will also not be available.









## TMFlow 1.76: Ethernet Slave

- Ethernet Slave functionality was introduced
- Up to 8 concurrent connections
- IP filter functionality available
- Read-only or read/write
- Configured similarly to what is accessible via Modbus

a Table	Setting		Enable					
		STA	.TUS: Disa	able				
		IP F	ilter:			~	Write Permission	
Rece	ive/Send	Data Table Setting	Setting Transmit Fi	le Name:	0	C Ipen E	ommunicate Mode :	
Predef	ined	User defined Global Variab	le					
	Item	Description	Data Type	Data Length	Accessibility	Write Restriction	n Note	
	Robot Error	Error or Not	bool	1	R		Yes:1 No: 0	A III
	hobot_thor							
	Project_Run	Project Running or Not	bool	1	R		Yes:1 No: 0	
	Project_Run Project_Edit	Project Running or Not Project Editing or Not	bool bool	1	R R		Yes:1 No: 0 Yes:1 No: 0	
	Project_Run Project_Edit Project_Pause	Project Running or Not Project Editing or Not Project Pause or Not	bool bool bool	1 1 1	R R R		Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0	
	Project_Run Project_Edit Project_Pause Get_Control	Project Running or Not Project Editing or Not Project Pause or Not Get Control or Not	bool bool bool bool	1 1 1	R R R		Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0	
	Project_Run Project_Edit Project_Pause Get_Control Camera_Light	Project Running or Not Project Editing or Not Project Pause or Not Get Control or Not Light	bool bool bool bool byte	1 1 1 1	R R R R R/W		Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0 Enable: 1 Disable: 0	
	Project_Run Project_Edit Project_Pause Get_Control Camera_Light Safeguard_A	Project Running or Not Project Editing or Not Project Pause or Not Get Control or Not Light Safety IO (Safeguard Port A trigger)	bool bool bool bool byte bool	1 1 1 1 1 1	R R R R/W R		Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0 Yes:1 No: 0 Enable: 1 Disable: 0 Triggered: 1 Restored: 0	

## TMFlow 1.76: Modbus

- The current project can be changed while in Auto mode by writing to an address
- TCP speed was also made available to read over Modbus

Run Setting	FC	Address <sub>10</sub>	Address <sub>16</sub>	Туре	R/W	Note
Current Project	04	7701~7799	1E15~1E77	String	R	
Change Current Project (Auto Mode only)	03	7701~7799	1E15~1E77	String	w	E.g. If the project is named TMflow, write TMflow\0 to this address. Only used in auto mode, and robot is not running.

#### TCP Speed

Robot Speed	FC	Address <sub>10</sub>	Address <sub>16</sub>	Туре	R/W	Note1	Note2
TCD Croad	04	7071 7070			Dword	mm/s	
TCP Speed	04	/8/1~/8/2	IEBF~IECU	FIOAL	ĸ	Dword	(According to current tool)

#### Change Current Project

## TMFlow 1.76: FTP Upload

- File Transfer Protocol (FTP) can be added in the Network Service page to create a virtual drive on the cobot's control box
- This allows you to share files, such as Project files, to a remote computer
- As of TMFlow 1.80 and while using a Network Service such as FTP, uploading source/result images does not require the TM SSD anymore



#### Before

Can only upload to shared drives/folders

#### Now

Supports FTP file protocol Creates a shared drive

\*Still need SSD to log images until v.1.80





## TMFlow 1.82: Fieldbus – PROFINET & EtherNet/IP

- EIP: Cobot acts as an EIP Server to send / receive data between itself and an EIP client.
- PROFINET: Cobot acts as a PROFINET I/O Device to send/receive data tables between itself and the I/O Controller
- EIP and PROFINET Communication Table includes System-defined (SDA) and Custom-defined (CDA) areas
- PLCs that support either protocol, Omron or otherwise, can access these Input and Output Tables
- PROFINET and EIP related functions and expression editor elements added
- PROFINET and EIP cannot be enabled at the same time

Co	ommunication Data Table (Robot's perspective)	Table Contents	TMflow EIP functions permissions			External device permissions	
Input Table		SDA	Read			Write	
		CDA		Read		Write	
C	Output Table	SDA		Read		Read	
		CDA	R	ead/Wi	rite	Read	
	Connection Robot				Profinet		•
	Profinet		-		profinet_	write_output()	•
	Sorial Port		profinet_		_write_output()		
	Socket				profinet_	write_output_bit()	
	Modbus Ethernet Slave			EtherNetIP		Р	•
	Profinet				eip_write_output()		-
EtherNetIP					eip_write_output()		
L					eip_write	_output_bit()	

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## TMFlow 1.82: EIP Network Topology

- Example network topology
- Cobot has two separate IP addresses

   one each for its LAN port and EIP port
- You can't change the default cobot EIP IP address within TMFlow



- NJ501: 192.168.250.1
- Cobot Ethernet IP: 192.168.250.40 (This is the EIP Server default IP)
- Cobot LAN port: 192.168.250.30
- PC: 192.168.250.23

#### TMFlow 1.84

 Focused on bug fixes, UI corrections, and minor updates



## TMFlow 1.84: TMFlow Improvements

- Joint torque average, min, and max values over the last 40ms added to the Modbus and Ethernet slave tables
- Safety connector port display in the Controller Menu modified to reflect the actual hardware layout





## Hardware Upgrades and Accessories

Related or necessary hardware components for TMFlow 1.76-1.84

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### TMFlow 1.76: Teach Pendant

- NexCobot Teach
   Pendant compatibility
   (P/N: RT6-A000020)
  - IP65 Rated
  - Anti-vibration / shock IEC/EN 61131-2 compliance
  - 10.1" touchscreen
  - 1.5kg (not including cable)
  - Robot Stick buttons integrated
- TMFlow 1.76 added a feature to turn on a pop-up keyboard



Pop-o Inp	out Keyboard	Keyboard or	Tablet	Penda	nt		
		If you choose keyboard and tab keyboard when you click the inp keyboard to automatically jump	Caution     Et mode, TMflow will no     out box. Please set the ta     out from the tablet.	t automatic blet to table	ally pop up the et mode to allo	e w the	
		The Pendant option can only be recommended teach pendant. In For details, please refer to the su	connection are correct. eselected when using the ncorrect selection or inst afety manual provided by	e TM robot's allation may y TM robot.	s officially v cause additio	nal risks.	
		-					_
≡ <	-			2	100 %		ī
Input/Dis	- splay Devices			2	100 %		ī
Input/Dis Inp	- splay Devices put Keyboard 🗹 Enable ut Devices	e Pop-out Keyboard 🏾		2	100 %		ī
Input/Dis Input/Dis Inp	splay Devices	e Pop-out Keyboard (2)		2	100 %	🚍 c	Ð
Input/Dis Input/Dis Inp	- splay Devices nut Keyboard ut Devices	e Pop-out Keyboard @ 2 3 4 5 6 e r t y u	8α * ( ) 7 8 9 0 i ο p 1	2	100 %	🖃 c	ī

## TMFlow 1.82: Omron Landmark

- Omron-branded landmarks introduced for version 1.82
- Dimensions, accuracy, etc is identical between the Omron and Techman branded landmarks
- Techman-branded landmarks are still functional for robots 1.82 and above



### Support Omron Ext. IO Modules

Coupler: NX-ECC201, NX-ECC202, NX-ECC203 Input: ID4442 , ID5342 Output: OD4121, OD5121, OD4256



#### **Digital Input Units**

• DC Input Units (Screwless Clamping Terminal Block, 12 mm Width)

1	Desident			S	pecification		Model	Standards		
Unit type name	name	Number of points	Internal I/O common	Rated input voltage	I/O refreshing method	ON/OFF response time				
DC Input Unit				12 to 24 VDC	Switching Synchronous I/O refreshing	20 μs max./ 400 μs max.	NX-ID3317			
		NPN	0000000000000	and Free-Run refreshing	100	NX-ID3343	1			
	DC Input Unit	4 points	4 points 24 PNP 12	24 VDC	Input refreshing with input changed time only *	100 ns max./ 100 ns max.	NX-ID3344	1		
		PNP		12 to 24 VDC	Switching Synchronous I/O refreshing and Free-Run refreshing	20 μs max./ 400 μs max.	NX-ID3417	UC1, N, L,		
Input Unit	2				Input refreshing with input changed	100 ns max./	NX-ID3443	KC		
					time only *	100 ns max.	NX-ID3444			
			NPN				NY-ID4342			
	1.00	8 points PNP 24 VDC Switching Synchronous I/O ref	Switching Synchronous I/O refreshing	20 µs max./	NX-ID4442					
					NPN		and Free-Run refreshing	400 µs max.	NX-ID5342	1
		16 points	PNP							

\* To use input refreshing with input changed time, the NJ-series CPU Unit with unit version 1.06 or later, EtherCAT Coupler Unit with unit version 1.1 or later, and Sysmac Studio version 1.07 or higher are required.

#### **Digital Output Units**

• Transistor Output Units (Screwless Clamping Terminal Block, 12 mm Width)



#### **Conversion Kits**

- Conversion kits are available to upgrade to HW version 3.2. Kits are specific to which version you are upgrading from, IE 3.0->3.2 or 3.1->3.2.
- HW 3.0 is compatible with v1.76-1.84
- Kits are specific to certain robot models
- The Omron Service dept must be contacted as they are required to perform the conversion.

19936-801F Kit to Convert Robot Hardware version 3.0 to 3.2 for TM5

19936-802F Kit to Convert Robot Hardware version 3.0 to 3.2 for TM5M

19936-803F Kit to Convert Robot Hardware version 3.0 to 3.2 for TM5M SEMI

**19936-804F** Kit to Convert Robot Hardware version 3.0 to 3.2 for TM12/TM14

19936-805F Kit to Convert Robot Hardware version 3.0 to 3.2 for TM12M/TM14M

19936-806F Kit to Convert Robot Hardware version 3.0 to 3.2 for TM12M SEMI/TM14M SEMI 19936-807F

Kit to Convert Robot Hardware version 3.1 to 3.2 for TM5/TM5X

19936-808F Kit to Convert Robot Hardware version 3.1 to 3.2 for TM5M/TM5MX

19936-809F Kit to Convert Robot Hardware version 3.1 to 3.2 for TM5M SEMI

**19936-810F** Kit to Convert Robot Hardware version 3.1 to 3.2 for TM12/TM14/TM12X/TM14X

19936-811F Kit to Convert Robot Hardware version 3.1 to 3.2 for TM12M/TM14M/TM12MX/TM14MX

19936-812F Kit to Convert Robot Hardware version 3.1 to 3.2 for TM12M SEMI/TM14M SEMI

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#### Fieldbus Models

- 24 various Fieldbusintegrated models of cobots are included across all payloads, reach distances, with / without camera
- Fieldbus adapter requires HW version
   3.0+ and TMFlow
   1.82+
- Fieldbus adapter installation requires Omron support

#### Part Number Structure

RT6 - 0000000

(1) (2) (3) (4) (5) (6) (7) (8)

	(7)	Semi / Fieldbus	Standard	0
			Semi	1
			Fieldbus	2

#### Without Fieldbus



#### With Fieldbus



#### Resources

#### Software and Manuals

- Software and manuals can be found under the "Downloads" section within the cobot Product Pages
- Omron TM Robots: <u>https://automation.omron.com/en/us/products/family/Omron%20TM%20Robots</u>
- Omron TMFlow: <u>https://automation.omron.com/en/us/products/family/Omron%20TM%20Software</u>

#### Training

- TMFlow programming 1 (In-person, virtual, and on-demand)
- TMFlow programming 2 (In-person)
- TMVision and Palletizing (In-person)

#### **Omron Technical Support**

- Free Customer Support 7AM 5PM CST
- Advanced Technical Support Services available
- <u>https://automation.omron.com/en/us/support/</u>



## Thank You

Adrian Choy, Product Manager – Robotics

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