

TT3148-01GB

9

9.1 Setting up wireless connection.

9.1.1 Setting up wireless connection.

Motors equipped with an Ethernet system is equipped with 2 Ethernet ports and an internal Ethernet switch.

When a motor is equipped with the wireless system, one of the Ethernet ports are used for the wireless connection.

The second Ethernet port is available but only in as wireless configuration.

The following equipment is recommended to get a reliable wireless network up and running.

- I. JVL motor equipped with the wireless option and running one of the following Ethernet protocols:
 - EthernetIP
 - ProfiNet
 - ModbusTCP
- 2. A good wireless access point designed for industrial use with good diagnostic features. In house tests has been conducted with Siemens Scalance W76x, other vendors offers the same features.
- 3. Industrial grade switch systems to manage the wired connections from the PLC and Access point(s).
- 4. MacTalk VI.90.019 or newer.

To get a reliable wireless network established requires some planning and a good knowledge of the environment the system is supposed to be working in.

However wireless networks are by definition not as reliable as the wired solution and loss of packages can occur at a random interval so the system must be designed to accommodate that.

Careful planning is also vital to get a good and reliable connection to the wireless nodes.

9.1 Setting up wireless connection.

The JVL wireless network can run in 2 different modes depending on which topology is required.

From MacTalk the configuration is done from the dialog that is accessed by pressing the "WIFI" -button.



Please note that configuration of the wireless network in the motor is only possible through a serial connection (not via Ethernet). When the wireless connection is running the motor can be accessed over the wireless connection, but the wireless settings are not available.

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Help Factory Status Configure Open	Ty V	WFFI Configurator - WFFI Hodule is Configured as Station Client From AT Command Console pe Statuo Client FFI Hodule is Configured as Station Client FFI Hodule is Configured as Station Client FC Address: S4E30000F71 SSID: Satue Interface: Connected MAC Address: S4E30000F71 SSID: Audor Sectup as Station Client Audor Sectup Aud	((q)) Mater n (Mater n
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9.1 Setting up wireless connection.

After the connection to the module has been established, the current setup is read and displayed in the "Status" -section.

Interface AT C	ommand Console				
Type Station C Wi-Fi Module i	lient 💛 s Configured as	Station Client	PLC + Access Point	1→ ((φ)) ((φ)) Motor 1 Motor 2	((p)) Motor n
			Motor Setup as Sta	ation Client	
Basic Settings MAC Address:	54E380000F71				5
SSID:					
Encryption:	Open	~			
Password:					
Status					
Interface	: Connected				
MAC Address	: 54E38000DF71				
	; JVL_EW42				
	WPA/WPA2	_	_		
Signal Strength		-35 dBm \sim			-
	Poor Exe	llent	Cyclic Update		Ø
Client AT Con	ole				
Relp		S	Factory 🕜 Sta	tus 🕡 Configure	e 🕢 Done
Ready @ 11	2khaud	_		-	

9.2 Status indicators at the WIFI module

On the WIFI antenna socket 2 LED's indicate the current status of the wireless connection.

Please note that for convenience the antenna has been removed in the following illustration, do not operate the device without the antenna connected.



LED overview

LED1	LED2	Description
Green	Green	No wireless setup in the motor, make a new setup from MacTalk.
Green	Purple	Connection attempt to either access point (Configuration #1) or Client (Configuration #2)
Green	Blue	Connection is established, blinking indicates traffic
OFF	Purple	Internal communication is missing between ethernet controller and wireless controller, connection is attempted on the wireless interface.
Off	Blue	Internal communication is missing between ethernet controller and wireless controller, connection is established on the wireless interface.
Off	Red	Internal error in the wireless controller, try setting factory default and make a new setup.

When the motor is configured as "Station Client", the secondary Ethernet port on the motor is not available. In other words it is **NOT** possible to connect other equipment to this port and reach it through the wireless connection.

The Access point connected to the PLC works as an access point and the motors connects to this access point and works as clients.



9.3.1 MacTalk "Station Client" configuration

nter face AT Command Console	
Type Station Client Wi-Fi Module is Configured as Station Client PLC + Access Motor 1 Motor 2	((•))
Motor Setup as Station Client Basic Settings	
MAC Address: 54E3B000DF71	64
SSID:* JVL_EW42	
Encryption: Open	
Password:	
⊡ Status	
Interface: Connected	
MAC Address: 54E3B000DF71	
SSID: JVL_EW42	
Encryption: WPA/WPA2	
Signal Strength: -31 dBm 🗸 🗌 Audio Feedback	

9.3.2 Basic settings

In this section data for the setup can be entered.

MAC Address:	Current MAC addr. of the Ethernet processor in the motor. Notice that the MAC address is a read only register.
SSID:	Enter the SSID of the access point.
Encryption:	Encryption method used in the access point. WPA/WPA2 can be selected.
Password:	Enter the WPA/WPA2 password of the access point. Note, by press- ing the "Eye"-button, the entered password is readable.

For more information on how to setup the access point, find the section Setting up the access point for configuration #1, page 240

9.3.3 Status

This section holds the actual setup and status of the wireless interface.

Interface:	Shows the connection state to an access point [Connected / Disconnected].
MAC Address:	Current MAC address used for the wireless interface. This address should be the same as the MAC address printed on the label.
SSID:	Current SSID configuration. This is the SSID the motor will try to connect to.
Encryption:	Current encryption setting [WPA/WPA2 or OPEN]. Observe that the password is protected from viewing.
Signal strength:	When the motor is connected, the signal strength can be monitored. The units can be presented in either [dBm or %]. In good industrial access points the signal strength of the clients can be monitored as well in the managing software for the access point.

When the settings has been configured, the setup is transferred to the motor by pressing the "Configure" -button found in the bottom of the dialogue.



Note: The settings are saved permanent in the motor after they are transferred.

-		
ype Station Cli		((•))
VIET PIOQUIC IS	Configured as Station Client	otor n
	Motor Setup as Station Client	
Basic Settings		1000
MAC Address:	54E38000DF71	H
SSID: *	JVL_EW42	
Encryption:	WPA/WPA2 V	
Password:	••••••	۲
Status		
Interface:	Connected	
and the second	54E3B000DF71	
	JVL_EW42 WPA/WPA2	
Signal Strength:		
Signal Suengun.	Poor Exellent Cyclic Update	0
Client AT Conso	le	

When the transferring has completed, the motor will connect to the access point with the SSID entered, using the encryption and credentials configured.

When the motor has established a wireless connection the status changes from "Disconnected" to "Connected".

The signal strength is also changed from "---" to a value either in dBm or %.

Interface: Connected	
MAC Address: 54E3B000DF71	
SSID: JVL_EW42	
Encryption: WPA/WPA2	
Signal Strength:	ack
Poor Exellent V Cydic Update	

In the screen-shot above the motor is connected to an access point with the SSID "JVL_EW42", there is no encryption configured. The signal strength is reported by the motor to be -20dBm (very good).

For a more human readable value the unit can be switched to %.

Signal Strength:	91	% ~
Poor	Exellent	TT3157-01GB

For the best performance and reliability the signal strength should always be in the "Excellent" -area of the status bar.

9.3.4 Setting up the access point for configuration #1

In this section we will cover the basic settings of the access point when a motor is configured as "Station Client".

The access point is the Ethernet wired to wireless gateway on which the PLC is connected.

The access point used is a Siemens Scalance W76x, but the same settings are available in other good industrial access points.

9.3.5 IP address of the access point

The IP address settings of the wired part must match the PLC settings. In this example all the equipment is running on the subnet 192.168.1.xxx. The access point is configured for the same range with the IP address 192.168.1.57.

SIEMENS	192.168.1.57/SCALANCE W761-1 RJ45
Welcome admin	Agent Internet Protocol v4 (IPv4)
Logout	
▶ Wizards	
►Information	IP Assignment Method: Static
▼System	IP Address: 192.168.1.57 Subnet Mask: 255.255.255.0
▶Configuration	Default Gateway: 0.0.0.0
▶General	Agent VLAN ID: - 👻
►Agent IPv4	MAC Address: d4-f5-27-9a-2a-4b
▶Agent IPv6 ▶DNS	Set Values Refresh
▶Restart	TT3158-010

The way IP addresses are configured can be manufacturer specific and is covered in the manual for the device.

9.3.6 SSID (ServiceSetIdentifier)

The SSID is basaically the identification on the wireless network. The SSID can be either visible or invisible for a scanner. When wireless networks are scanned it is the SSID of the networks that appears in the list.

In this example we use "JVL_EW42" as SSID, in the Siemens configuration this is setup in the following dialog:

Access Point Settings								
				↓				
	nced Ante	ennas Allo	wed Chann	els 802.11n AP AP WD	S AP 802.11a/b/g Rates	AP 802.11n Rate	s Force R	oaming
				an familia familia				
	Radio	Channel		Alternative DFS Channel	HT Channel Width [MHz			
	WLAN 1	Auto						
	Radio	Available	Channels					
	WLAN 1	11						
	Radio	Port	Enabled	SSID		Broadcast SSID	WDS only	WDSI
	WLAN 1	VAP 1.1		JVL_EW42				
Warning	The appro	val process	may not be	e linished in current count	ry for channels denoted b	y a **' character.		
	Please ch	eck the follo	wing webs	ite for more detailed infor	mation:			
Set Valu	Refres	h						
	Basic Adva	Basic Advanced Ante Radio WLAN 1 Radio WLAN 1 Radio WLAN 1 Radio WLAN 1 Radio Please ch http://www	Basic Advanced Antennas Allo Radio Channel WLAN 1 Auto Radio Available WLAN 1 11 Radio Port WLAN 1 VAP 1.1 Warning: The approval process Please check the folk	Basic Advanced Antennas Allowed Chann Radio Channel WLNN 1 Auto ✓ Radio Available Channels WLNN 1 11 Radio Port Enabled WLNN 1 VAP 1.1 ☑ Warning: The approval process may not be Please check the following webs http://www.siemens.com/wireles	Basic Advanced Antennas Allowed Channels 802.11n AP AP WD Radio Channel WLAN 1 Auto Radio Available Channels WLAN 1 Auto Radio Available Channels WLAN 1 11 Radio Port Enabled JML_EW42 Warning: The approval process may not be linished in current count Please check the following website for more detailed infor http://www.siemens.com/Wireless-approvals	Basic Advanced Antennas Allowed Channels 802.11n AP AP WDS AP 802.11a/big Rates Radio Channel Alternative DFS Channel HT Channel Width [MH2] WLAN 1 Auto 20 Radio Available Channels 20 WLAN 1 11 Radio Port Enabled JVLAN 1 11 JVL_EW42 Warning: The approval process may not be linished in current country for channels denoted by Please check the following website for more detailed information: http://www.stemens.com/wireless-approvals	Basic Advanced Antennas Allowed Channels 802.11n AP AP WDS AP 802.11a/big Rates AP 802.11n Rate Radio Channel Alternative DFS Channel HT Channel Width [MHz] WLAN 1 Auto 20 20 Radio Available Channels 20 20 WLAN 1 11 SSID Broadcast SSID WLAN 1 VAP 1.1 VA_EW42 V Warning: The approval process may not be linished in current country for channels denoted by a " character. Please check the following website for more detailed information: http://www.semens.com/Wireless-approvals SSID SSID	Basic Advanced Antennas Allowed Channels 802.11n AP AP WDS AP 802.11a/big Rates AP 802.11n Rates Force R Radio Channel Alternative DFS Channel HT Channel Width [MH2] WLAN 1 Auto 20 Radio Available Channels 20 WLAN 1 11 Enabled SSID JM_EW42 Proadcast SSID WLAN 1 VAP 1.1 JM_EW42 Warning: The approval process may not be Inished in current county for channels denoted by a ** character. Please check the following website for more detailed information: http://www.stemens.com/Wireless-approvals

9.3.7 Encryption

The encrytion scheme supported in the motor is WPA/WPA2. The password "MONKEY123" is chosen and configured in the access point.

Welcome admin		curity Settings	seconds.Pres	ss Write Startup Con	ig to save immediately		
•Wizards	Basic AP Com	munication AP RADIUS Aut	henticator K	eys			-
Information	Port VAP 1.1	Authentication Type	Encryption	Cipher AUTO	WPA(2) Pass Phrase	WPA(2) Pass Phrase Confirmation	Default Key 1
▶System		Open System		1010		,	1100
▶ Interfaces	Set Values	Shared Key					
▶Layer 2		WPA (RADIUS) WPA-PSK					
 Security 		WPA2 (RADIUS)					
⊁Users		WPA2-PSK					
+Passwords		WPA/WPA2 AUTO (RADIUS)	ka i				
+AAA		WPA/WPA2-AUTOPSK					
► WLAN		2	-				
►MAC ACL							
▶IP ACL							
 Management ACL 							

The same password credentials must be configured in the motor. Press the "Configure" button to transfer the settings to the motor.

Interface AT Command Console	
Type Station Client Wi-Fi Module is Configured as Station Client	((q)) (q)) PLC \leftrightarrow Access Point Motor 1 Motor 2 $\cdots $ Motor n
	Motor Setup as Station Client
Basic Settings	anness anness
MAC Address: 54E3B000DF71	
SSID: * JVL_EW42	<u></u>
Encryption: WPA/WPA2 V	
Password: MONKEY123	٤.
3161-01GB	
	Hint ! By pressing and holding down the "Eye" -button, the Password is visib

When everything has been configured, the motor will try establishing a connection to the access point.

when the connection has been established, the LED's on the motor will show the following indication:



NOTE : The above image shows a motor without the antenna connected, this is purely for demonstration reasons, do not operate the motor without the antenna connected.

9.4

Each wireless motor is configured as an access point and the PLC is connected to a wireless client. This method leaves the secondary Ethernet port in the motor, open for connecting another wired node and the internal switch in the motor will route the packages through the wireless network to and from the PLC to the nodes connected to the port. The drawback of this setup is that it gets very complicated requiring a lot of bandwidth if many wireless "strings" are needed. The PLC and each Client should be connected to a industrial grade managed switch.



9.4 Configuration #2, Access point

9.4.1 Mactalk setup "Access point"

When the motor acts as an access point there are more settings that must be considered. An additional set of IP addresses must be setup.

Type Access Point Wi-Fi Module is Configured as Station Client	((¶)) PLC →→ Client * Motor 1 → Motor 2 → ···· Motor n
Basic Settings	* Access Point Setup as Client
SSID: • JML_EW42	
Hidden SSID	
Channel: 1	
Encryption: WPA/WPA2 V	
Password:	
Password:	
IP Address: * 192 168 1 20	
Subnet Mask: * 255 255 255 0	
Gateway: * 192 168 1 20	
Gateway: * 192 168 1 20	5 8
- Status	
Interface: -	
Client MAC Address: -	
SSID: -	
Hidden SSID: -	
Channel: -	
Encryption: -	
IP Address: -	
Subnet Mask: - Gateway: -	

9.4.2 Basic settings

In this section data for the setup can be entered.

SSID:	Enter the SSID for the Access point. This is the ID the motor will use for the Clients to connect to.
Hidden SSID:	Check this setting if the SSID should not be visible in a network scan.
Channel:	Select the channel for the Access point configuration.
Encryption:	Select the encryption that must be used. Note, by pressing the "Eye"- button, the entered password is shown.
Password:	Enter the WPA/WPA2 password of the access point. Note, by pressing the "Eye"-button, the entered password is shown.
IP Address:	Enter the IP address that the Wireless adapter in the motor should have. Note the clients that connects to this motor must be in the same subnet.
Subnet Mask	Subnet mask settings of the wireless network.
Gateway:	Gateway settings the wireless adapter.

For more information on how to setup the access point, find the section Setting up the accesspoint for the Configuration #2, page 247

9.4 Configuration #2, Access point

9.4.3 Status

This section holds the actual setup and status of the wireless interface.

Interface:	Shows the connection state to an access point [Connected / Discon- nected].
MAC Address:	Current MAC address used for the wireless interface. This address should be the same as the MAC address printed on the label.
SSID:	Current SSID configuration. This is the SSID the motor will try to connect to.
Encryption:	Current encryption setting [WPA/WPA2 or OPEN]. Observe that the password is protected from viewing.
Signal strength:	

Status		
Interface:	Active	TT3165-01GB
Client MAC Address:		
SSID:	JVL_EW42	
Hidden SSID:	No	
Channel:	1	
Encryption:	WPA/WPA2	
IP Address:	192.168.1.20	
Subnet Mask:	255.255.255.0	
Gateway:	192.168.1.20	0
Interface: Client MAC Add SSID: Hidden SSID: Channel: Encryption: IP Address: Subnet Mask: Gateway:	Active/Passive ress: Not used Setting of the SSID that clients can connect to. Yes/No Active channel number Encryption method used. IP address of the wireless access point in the motor. Subnet mask Gateway	

When the settings has been configured, the setup is transferred to the motor by pressing the "Configure" -button found in the bottom of the dialogue.

Wi-Fi Configurator - Wi-Fi Module is Config Interface AT Command Console	gured as Access Point >
Type Access Point Wi-Fi Module is Configured as Access Point	((p)) ((p)) PLC +- Client * Motor 1 Motor 2 · · · · Motor n * Access Point Setup as Client
Basic Settings	Access Point Setup as Clent
SSID:= JVL_EW42	
Hidden SSID	
Channel: 1	
Encryption: WPA/WPA2 V	
Password:	۲
IP Address: * 192 168 1 20	
Subnet Mask: * 255 255 255 0	
Gateway: * 192 168 1 20	6 8
⊡Status	
Interface: Active	
Client MAC Address: SSID: JVL_EW42	
Hidden SSID: No	
Channel: 1	
Encryption: WPA/WPA2 IP Address: 192, 168, 1, 20	
Subnet Mask: 255,255,255,0	
Gateway: 192.168.1.20	
Access Point AT Console	

9.4

9.4 Configuration #2, Access point

9.4.4 Setting up the accesspoint for the Configuration #2

SIEMENS	192.168	3.1.57	/SCA	LANCE	E W761-1	RJ45				01/01/	English - 52
Wetcome admin	WLAN Basic	c Radio	Settings								Clie
	Basic Advanced	Antennas	Allowed C	hannels 802	.11n Client Signal F	Recorder Force Roamin	10				
Information	Country Code:		d	~							
• System	Device Mode:	Radio WLAN 1	Enabled	Radio Mode Client	Frequency Band	WLAN Mode 2.4 GHz	WLAN Mode 5 GHz	DFS (802.11h)	Outdoor Mode	Tx Power Check Allowed	1
Elbernel WLAN		The device		permitted for	use in countries den	ooted by a * character.				 	
+Remote Capture				wing website to on/wireless-a	for more detailed info pprovals	ormation:					
Layer 2	Sat Values R	lefresh									TT3167-01GB

Observe the Device mode and the Radio mode which is set to "Client". Encryption is configured according to the encryption settings configured from MacTalk.

	192.168.1	1.57/SCALA	NCE	W70	61-1 R	J45))			
Welcome admin	WLAN Security	y Settings								
Loopud										
▶ Wizards	Basic Client RADIUS	Supplicant Keys								
Information	Security Context		En	cryption	Cipher		WPA(2) Pass Phrase	WPA(2) Pass Phrase Confirmation	Default Key	
▶System	1	WPA2-PSK	*	2	AES	~	•••••		Key 1	Ŷ
	1 entry.									
Interfaces	Create Delete	Set Values Refresh								
Layer 2	Contractory Contractory C									
·Security										
+Users										
▶Passwords										
+ AAA										
+WLAN										
+ MAC ACL										
+IP ACL										
+Management ACL									TT316	8-01GB

The Password is of course defined in the motor, since the motor acts as the access point. The Password is in this case MONKEY123 as configured from MacTalk.

When everything has been configured, the motor will wait for Client(s) to connect, when a client is connected, the LED's on the motor will show the following indication:



Green and Blue indicates that the internal bridging between the wireless chip and the Ethernet controller has been established.

The blue LED indicates that the wireless connection is established. When data is transmittet the LED's are blinking indicating the traffic.

NOTE: The above image shows a motor without the antenna connected, this is purely for demonstration reasons, do not operate the motor without the antenna connected. In some cases it may be necessary to reduce the RPI (Requested Package Interval) compared to a classic wired connection.

The bandwidth of the wireless network can be significantly lower than the bandwidth of a wired connection.

In order to have a stable reliable connection it is imperative needed that the correct settings are achieved in the access point.

Using a good access point designed to work in an automation environment is the first step to success establishing a wireless network.

Wireless networks will always be less deterministic than a traditional wired Ethernet network, so careful planning must be done with considerations of lost connections, lost packages etc.

Most access points designed for industrial use, supports a lot of fine tuning to optimize the infrastructure for the actual usage end existing infrastructure.

This section will cover some of the considerations and features modern access points offer for industrial use.

All demonstrations are carried out using the **Siemens Scalence W761** -Access point and configuration software.

First step in determining how reliable or/and fast a wireless network can be on the plant floor is to analyze the channels in use and the traffic load on each.

Please note that most access points offer running on both 2.4GHz and 5GHz so in case channels are heavily loaded on 2.4GHz, 5 GHz can be used instead.

The JVL wireless system supports running either 2.4GHz or 5GHz.

The channel selection determines whether the motor operates on 2.4GHz or 5 GHz.

For operation in 2.4GHz, select a channel in the range: I - II

For operation in the 5GHz band, select a channel in the range: **36 - 64, 100 - 116, 132 - 140.**

NOTE:

Observe the local regulations of allowable channels before commissioning.

9.5

WIFI settings for optimal quality

9.5

Spectrum analyzer in Siemens Scalence W761 Showing the channel load on the different channels at 2.4GHz.



WIFI settings for optimal quality

Motor and access point appx. 300mm apart using a std. JVL antenna on the motor. On the 5GHz frequency band the channel loading on Channel 36-48, leaving Channel 40 as a good choice of operation:



SIEMENS		.16	3.1.57	SCAL	ANCE W7	61-1 RJ4	5								
instance allowed	WLAP	N Ciler	vts												
Wizarda	Overview	AP CB	ent List WE	IS List Over	tap AP Force Roaming	Nome Floor									
+internation	Asso	coaled (tations: 1												
+ Stat Page + Versiene	AID 1	Radia WLAN		Type Station	MAC Address 54-e3-50-03-df 71	Bystem Name	Channel 6	Signal Strength (dBm) -21	Signal Strength (%) 100	Age [k] O	Security Open System	WLAN Mode 802 11 n	Max, Data Rate (Mops) #5.0	State connected	
+164 +APD*/ falightors +LogTables +Tables +Tables +Recordancy	(Ref)	esh)													
+ Chemet Statistics														TT	3173-01GB

Note the reception quality in the motor can be monitored from the access point web interface.

Note that all the settings are available from TIA portal and can be saved into a TIA portal project.

All JVL examples include the complete project for TIA Portal or Rockwell studio. A lot of information is available on the internet regarding planning and designing of wireless networks. Covering everything is beyond the scope of this manual.

9.5

On the JVL web page in the download section all the example projects can be found and downloaded.

Follow the link: https://www.jvl.dk/List/310/Downloads