4.0 Readiness Level

Technical report

Bergamo, 12-06-2021

INTELLIMECH®
CONSORZIO PER LA MECCATRONICA

INDEX

1. The technological context: the Industry 4.0 scenario

The term Industry 4.0, also known as the fourth industrial revolution, represents the current technological and industrial scenario.
It is characterised by the use and application of sensors and information technologies to analyse data with the aim of improving the efficiency of production processes and increasing their added value on the market.
The Industry 4.0 model revolutionises the entire value chain through the integration of upstream suppliers and downstream customers networks: business models, approaches to the market and the production process are thus revisited in order to achieve efficiency and productivity improvement.
Thanks to the Industry 4.0 paradigm, it is possible to interconnect and make all production resources cooperate by collecting and analysing data and information generated by factory systems.
The enabling technologies of Industry 4.0 can be summarised in the following three areas:

1. Availability of digital data and Big Data analytics
2. Robotics and advanced automation
3. Advanced connectivity

In a limited, sporadic and poorly integrated way, the above technologies are sometimes already available in some companies, mainly in industrial process control for mass production of components.
The Industry 4.0 revolution aims to create and manage real integrated and interconnected networks of machinery, plants and production facilities, optimising transformation processes, reducing errors and defects, improving time to market and ensuring flexibility and speed to the production process.

The objective of this analysis is to verify that the characteristics of the asset correspond to the "Industry 4.0" concept and to certify consequently the suitability of the asset to be included in the list of goods and services necessary for the modernisation of the industrial organisation in view of Industry 4.0. This certificate is useful for companies wishing to take advantage of the benefits for the transition to Industry 4.0 if and when the law provides for it.

Almost all countries that provide tax benefits for the purchase of goods useful for the transition to Industry 4.0 **require that the goods are not only Industry 4.0 compliant, but also interconnected to factory information systems.** In order for an asset to be defined as "interconnected" for the purposes of obtaining the benefit, it is necessary and sufficient that:

a) The ability of the asset to exchange information with internal systems (e.g.: management system, planning systems, product design and development systems, monitoring, even remotely, and control other machines in the plant, etc.) and/or external systems (e.g.: customers, suppliers, partners in collaborative design and development, other production sites, supply chain, etc.) by means of a connection based on documented, publicly available and internationally recognised specifications (examples: TCP-IP, HTTP, MQTT, etc.).

b) In addition, the asset must be uniquely identified, in order to recognise the origin of the information, through the use of internationally recognised addressing standards (e.g. IP address);

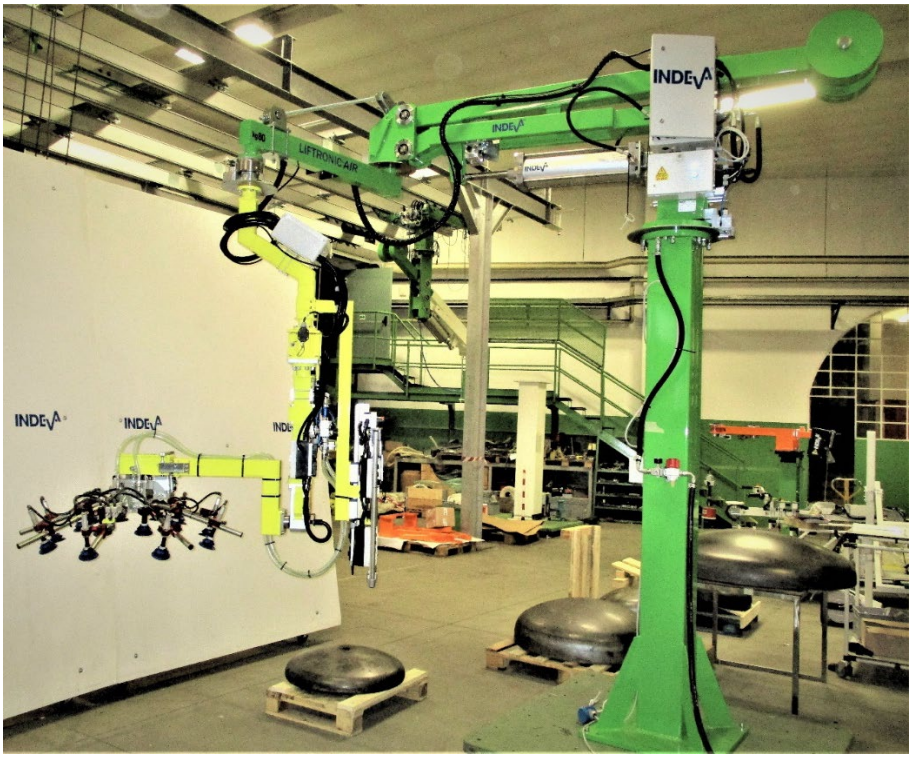
Therefore, the responsibility for the interconnection of the asset is on the buyer of the asset itself and not on the supplier, since the interconnection according to the definition given above depends on the former.

This study therefore does not replace the certification and/or expert's report on the asset, which are necessary declarations in order to benefit from the tax relief, if provided for by law. “Consorzio Intellimech” declines all responsibility for the fulfilment of the asset's interconnection requirement, which remains the responsibility of the end user.

2. Machine description

The subject of the report is the industrial manipulator produced by Scaglia Indeva with electronic control and pneumatic drive of the Liftronic® Air Series. This device is a zero-g manipulator used in production lines to facilitate the movement and handling of components whose weight and shape make manual handling too dangerous or uncomfortable. In addition, the special operator interface with its sensitive handle allows effective and intuitive control of the handling process, giving the operator analogue control of the speed of ascent and descent.

Concerning the end-effector necessary for handling a load, the machine can be equipped with either a hook or a custom designed gripper.



Picture1 Industrial Manipulator INDEVA® Liftronic® Air

The machine is also connected to a communication gateway that can communicate process parameters to and from the machine via a Wi-Fi connection.

The Liftronic® Air industrial manipulator by Scaglia Indeva falls within the list of assets with the following characteristics, which are usually included in the list of requirements used by most Countries to identify an "industry 4.0 ready" industrial manipulator:

"Devices for human-machine interaction and for improving the ergonomics and safety of the workplace in logic 4.0" and

"Systems for lifting/translation of heavy parts or objects exposed to high temperatures able to facilitate the operator's task in an intelligent/robotic/interactive way";

Analysis of the machine characteristics to ascertain their conformity with the requirements of "Industry 4.0

A system that can be interconnected with other machines and company systems is normally considered suitable for Industry 4.0.

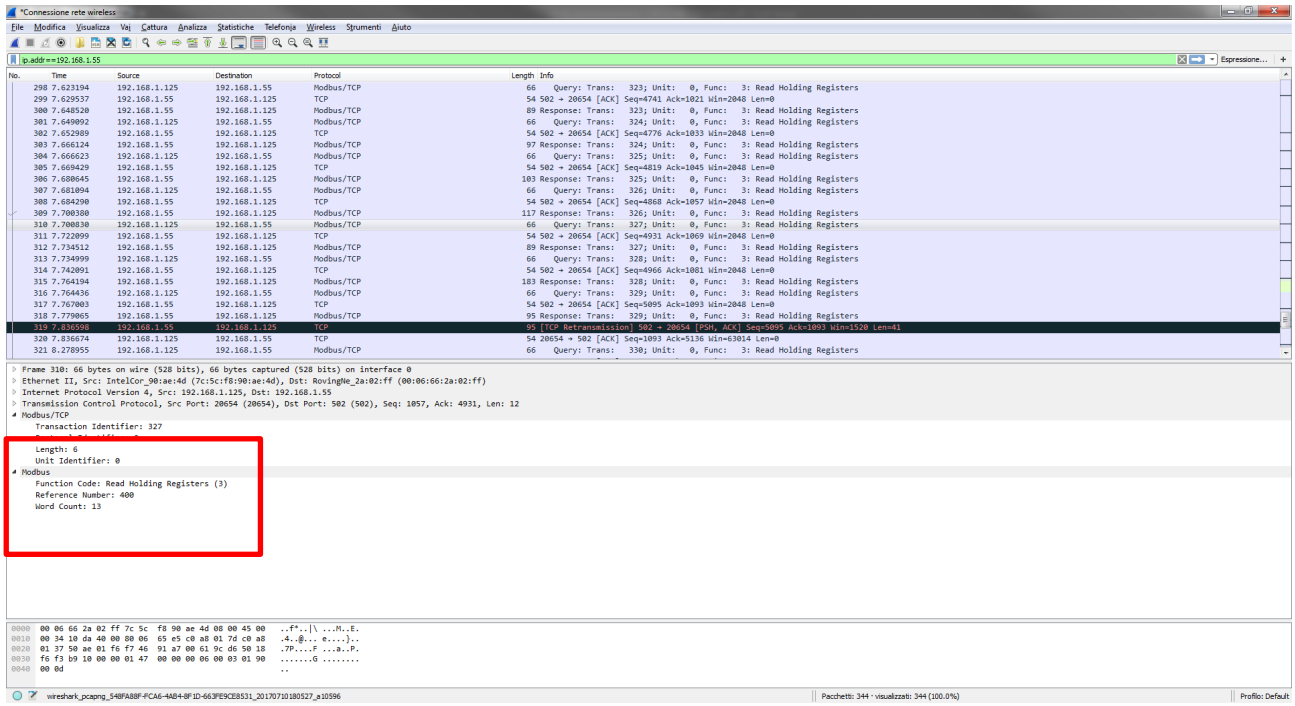
For example, the law for tax benefits in Italy mentions:

The ability of the asset to exchange information with internal systems (e.g.: management system, planning systems, product design and development systems, monitoring, even remotely, and control other machines in the plant, etc.) and/or external systems (e.g.: customers, suppliers, partners in collaborative design and development, other production sites, supply chain, etc.) by means of a connection based on documented, publicly available and internationally recognised specifications (examples: TCP-IP, HTTP, MQTT, etc.). In addition, the asset must be uniquely identified, in order to recognise the origin of the information, through the use of internationally recognised addressing standards (e.g. IP address);

3.1 Ability to exchange information with internal or external systems

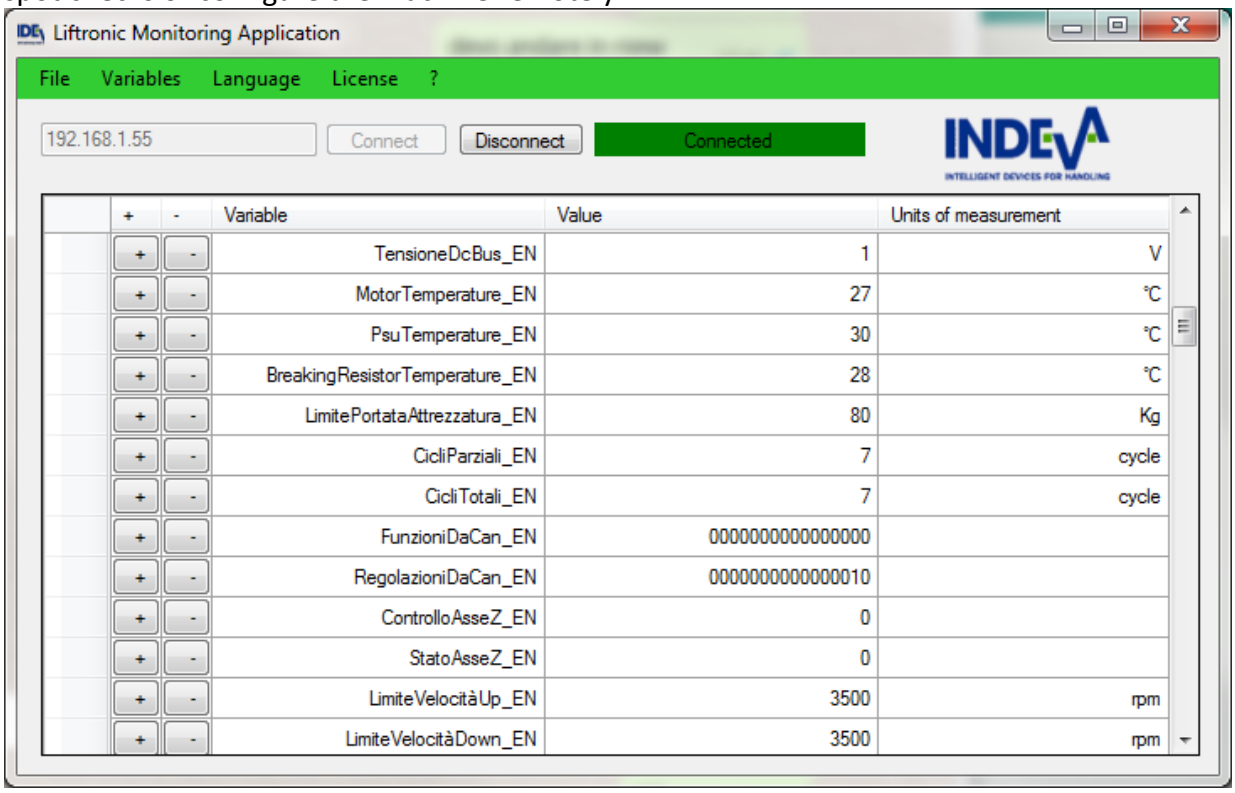
The exchange of information with internal or external systems is guaranteed by the presence of the communication gateway. This allows two-way communication from the machine to the company systems using the standard Modbus TCP protocol. Using this protocol, it is possible to obtain all the operating and diagnostic parameters from the machine and set the operating parameters.

The compliance of the communication protocol with the standard was verified by analysing the network traffic to and from the machine as shown in the following image.



Picture 2 - Analysis of network traffic and identification of the communication protocol used

As the implemented protocol is fully compatible with the Modbus TCP standard, it is possible to control and perform diagnostics on the machine from any commercial control or SCADA system that supports this protocol (now considered the de facto standard in these fields). It is also possible to use specific software such as the following Liftronic® Monitoring System to perform spot checks or configure the machine remotely.

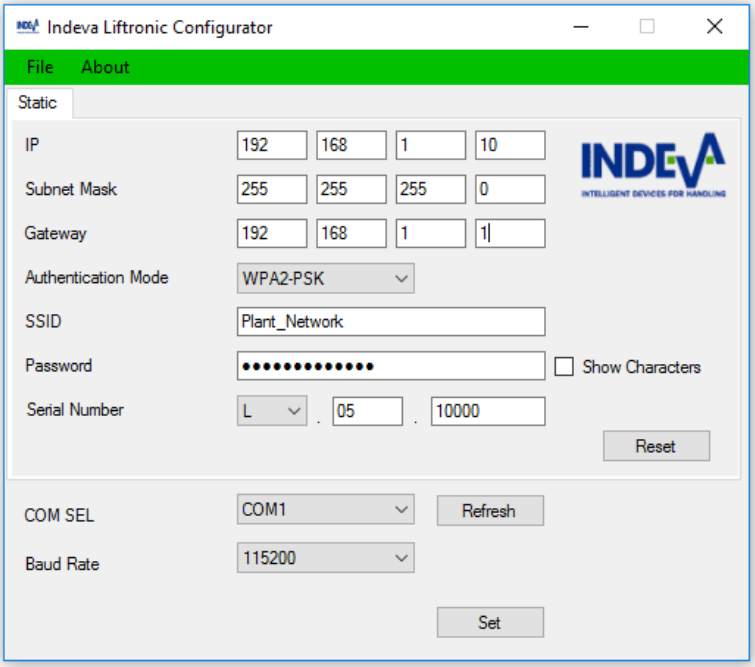


Variable	Value	Units of measurement
TensioneDcBus_EN	1	V
MotorTemperature_EN	27	°C
PsuTemperature_EN	30	°C
BreakingResistorTemperature_EN	28	°C
LimitePortataAttrezzatura_EN	80	Kg
CicliParziali_EN	7	cycle
CicliTotali_EN	7	cycle
FunzioniDaCan_EN	0000000000000000	
RegolazioniDaCan_EN	0000000000000010	
ControlloAsseZ_EN	0	
StatoAsseZ_EN	0	
LimiteVelocitàUp_EN	3500	rpm
LimiteVelocitàDown_EN	3500	rpm

Picture 4 - Remote Machine Monitoring using Liftronic® Monitoring Application

3.2 Ability to be uniquely identified in order to recognise the origin of the information

The system can be uniquely identified on the network on the basis of the static IP address assigned to the gateway using the configuration software supplied. This software also makes it possible to configure all the necessary parameters for connection to the system's Wi-Fi infrastructure.



Picture 2 - IP address configuration and network parameters

3. CONCLUSIONS

On the basis of the analysis shown above, the Liftronic®Air manipulator, equipped with the software and hardware systems analysed and mentioned here above and described in the user and maintenance manual, **meets the requirements for being "4.0 compliant".**