ICS 17.220.20
CCS N29

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/Z 43973-2024

Sensing devices for non-intrusive load monitoring (NILM) systems

非介入式负荷监测（NILM）系统用感知装置

Issued on: April 25, 2024 **Implemented on: November 1, 2024**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting: This document is equivalent to IEC TS63297:2021 "Sensor devices for non-intrusive load monitoring (NILM) systems", and the file type is The IEC technical specifications have been adjusted to become my country's national standardization guiding technical documents: The following minimal editorial changes were made to this document:

--- Adjust the standards cited in the definitions of terms from references to Chapter 2;

--- Table B:1 adds table notes: Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents: This document was proposed by the China Machinery Industry Federation: This document is under the jurisdiction of the National Technical Committee for Standardization of Electrical Instruments (SAC/TC104): This document was drafted by: Marketing Service Center of State Grid Jiangsu Electric Power Co:, Ltd:, Harbin Electric Instrument Research Institute Co:, Ltd:, State Grid Zhejiang Electric Power Co:, Ltd: Marketing Service Center, State Grid Metering Center Co:, Ltd:, Shenzhen Kelu Electronic Technology Co:, Ltd:, Jiangsu Linyang Energy Co:, Ltd:, Wuxing Technology (Shenzhen) Co:, Ltd:, Heilongjiang Electrical Instruments Engineering Technology Research Center Co:, Ltd: Department, State Grid Shandong Electric Power Company Marketing Service Center (Metering Center), State Grid Jiangxi Electric Power Company Power Supply Service Management Center, State Grid Jilin Electric Power Co:, Ltd: Marketing Service Center, Nanjing Feiteng Electronic Technology Co:, Ltd:, State Grid Chongqing Electric Power Company Marketing Service Center, Ante Instrument Group Co:, Ltd:, Huali Technology Co:, Ltd:, Xidian University, State Grid Anhui Electric Power Co:, Ltd: Marketing Service Service Center, China Electric Power Research Institute Co:, Ltd:, Ningbo Canaan Intelligent Electric Co:, Ltd:, China Southern Power Grid Shenzhen Power Supply Bureau Co:, Ltd:, Shanghai Qianjuzhi Technology Co:, Ltd:, Yunnan Power Grid Co:,

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Non-intrusive load monitoring (NILM) or non-intrusive appliance and load monitoring (NIALM) is a method of monitoring the load at a single monitoring point in a facility: The process of using load characteristics to provide estimated electricity usage (such as heating, cooling, etc: by usage type, or microwave ovens, etc: by appliance type): Non-intrusive load monitoring systems can be used to investigate the specific use of electrical energy in residential, building or industrial areas (see Figure 1): Figure

1 Schematic diagram of non-intrusive load monitoring principle At present, non-intrusive load monitoring systems are basically used in AC distribution networks, but DC distribution networks are not excluded: Non-Intrusive Load Monitoring (NILM) Sensor device for system

1 Scope

GB/Z 43973-2024 covers the sensing hardware for non-intrusive load monitoring. NILM works out which appliances are running in a building from a single measurement point at the incoming supply, by recognising each device's signature in the aggregate current and voltage - no sensor on the appliance, no meter per circuit. That is what makes it attractive to utilities and to energy management: one device at the meter position instead of a rewiring job. The whole approach stands or falls on the front end, because the features the

algorithms rely on are transients and harmonic content that a sensor with too low a sampling rate or too coarse a resolution simply never captures, and no amount of processing recovers what was not measured. This document presents the current state of the art in NILM systems and gives the classification of NILM sensing devices, leaving the disaggregation algorithms to possible future work. As a GB/Z it is a guiding technical document, which suits a field still consolidating. Under ICS 17.220.20 and CCS N29, it is written for the makers of metering and sensing hardware, for the energy management and demand response services built on it, and for the utilities evaluating it.

This document attempts to provide the latest state of the art in non-intrusive load monitoring (NILM) systems: Classification of NILM sensing devices: In the future, we may consider the NILM decomposition algorithm and the classification of NILM systems, as well as the performance indicators of NILM systems: NILM systems generate an estimated breakdown of electricity usage: Accurate measurement and analysis of energy consumption and/or other electrical parameters is required When used for monitoring electrical facilities, use a standard measuring device (such as a power measurement and monitoring device (PMD), power quality monitoring device (PQM) or a power quality monitoring device (PQM)): equipment (PQI) or instrument]:

Note: In addition to safety and structural requirements, standardized measuring devices guarantee accuracy within the specified range and are not affected by influencing quantities (such as temperature, frequency deviation, etc:) See Appendix C for more information:

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document: For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document:

GB/T 39853:1-2021 Power quality measurement in power supply systems Part 1: Power quality monitoring equipment (PQI) (IEC 62586-1:2017, IDT) IEC 61000-4-

30 Electromagnetic compatibility Part 4-30: Testing and measurement techniques Power quality measurement methods mentmethods)

GB/T 17626:30-2023 Electromagnetic compatibility test and measurement technology Part 30: Power quality measurement method (

IEC 61000-4-30: 2021,MOD)

3 Terms and definitions

The following terms and definitions apply to this document: ISO and IEC maintain

databases of terminology relevant to standardization at the following URLs:

---ISO online browsing platform: http://www:iso:org/obp: 3:

1 Electrical parameterselectricalparameter The electrical quantity to be measured or estimated: Examples: current RMS value (effective value), voltage RMS value, active power, reactive power, harmonics and power quality related parameters, etc: 3:2 estimated value Electrical parameters (such as current, load, and load conditions) generated by a non-intrusive load monitoring (NILM) sensing device or NILM system