

RobotFramework_UDS

v. 0.1.0

TODO

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Contents

1	Introduction	1
2	Description	2
2.1	Overview	2
2.2	UDS Connector (DoIP)	2
2.3	Configuration	2
2.4	Supported UDS Services	2
2.5	Enhancements Usability with ODXTools Integration	2
2.6	Examples	2
3	DiagnosticServices.py	5
3.1	Class: DiagnosticServices	5
3.1.1	Method: get_data_by_name	5
3.1.2	Method: get_encoded_request_message	5
4	UDSConnector.py	6
4.1	Class: UDSConnector	6
4.1.1	Method: get_connection	6
4.2	Class: UDSConnectorManagement	6
4.2.1	Method: get_supported_type	6
4.2.2	Method: create_connector	6
4.3	Class: DoIPConnector	6
4.3.1	Method: get_connection	6
5	UDSKeywords.py	7
5.1	Class: UDSKeywords	7
5.1.1	Method: connect_uds_connector	7
5.1.2	Method: create_uds_connector	7
5.1.3	Method: load_pdx	8
5.1.4	Method: build_payload	8
5.1.5	Method: validate_content_response	8
5.1.6	Method: create_config	8
5.1.7	Method: set_config	8
5.1.8	Method: connect	8
5.1.9	Method: disconnect	8
5.1.10	Method: access_timing_parameter	9
5.1.11	Method: clear_dianostic_infomation	9
5.1.12	Method: communication_control	9

5.1.13	Method: <code>control_dtc_setting</code>	10
5.1.14	Method: <code>diagnostic_session_control</code>	10
5.1.15	Method: <code>dynamically_define_did</code>	10
5.1.16	Method: <code>ecu_reset</code>	10
5.1.17	Method: <code>io_control</code>	11
5.1.18	Method: <code>link_control</code>	11
5.1.19	Method: <code>read_data_by_identifier</code>	11
5.1.20	Method: <code>request_transfer_exit</code>	12
5.1.21	Method: <code>request_upload</code>	12
5.1.22	Method: <code>routine_control</code>	12
5.1.23	Method: <code>security_access</code>	13
5.1.24	Method: <code>tester_present</code>	13
5.1.25	Method: <code>transfer_data</code>	13
5.1.26	Method: <code>write_data_by_identifier</code>	13
5.1.27	Method: <code>write_memory_by_address</code>	14
5.1.28	Method: <code>request_file_transfer</code>	14
5.1.29	Method: <code>authentication</code>	14
5.1.30	Method: <code>routine_control_by_name</code>	15
5.1.31	Method: <code>read_data_by_name</code>	15
5.1.32	Method: <code>get_encoded_request_message</code>	16
6	<code>__init__.py</code>	17
6.1	Class: <code>RobotFrameworkUDS</code>	17
7	Appendix	18
8	History	19

Chapter 1

Introduction

The library **RobotFramework-UDS** provides a set of **Robot Framework** keywords for sending UDS (Unified Diagnostic Services) requests and interpreting responses from automotive electronic control units (ECUs).

Whether you're testing diagnostic sessions, reading data, or controlling routines on an ECU, the UDS Library simplifies these tasks by offering specific keywords like `DiagnosticSessionControl` , `ReadDataByIdentifier` , and `RoutineControl` .

These keywords are designed to handle the complexity of UDS communication, enabling you to write efficient and reliable automated tests.

Moreover, you can now refer to UDS services by their readable names rather than hexadecimal IDs e.g `ReadDataByName` , `RoutineControlByName` . It helps to make your tests more intuitive and easier to maintain.

Chapter 2

Description

2.1 Overview

The **RobotFramework-UDS** is designed to interface with automotive ECUs using the UDS protocol over the DoIP (Diagnostic over IP) transport layer. This library abstracts the complexities of UDS communication, allowing users to focus on writing high-level test cases that validate specific diagnostic services and responses.

2.2 UDS Connector (DoIP)

Currently, the library supports the **DoIP** (Diagnostic over IP) transport layer, which is commonly used in modern vehicles for diagnostic communication. DoIP allows for faster data transfer rates and easier integration with network-based systems compared to traditional CAN-based diagnostics.

2.3 Configuration

In order to connect and send/receive message properly using the **RobotFramework-UDS** certain configurations must be set up:

- DoIP Configuration: The library requires the IP address and port of the ECU or the gateway through which the ECU is accessed.
- Data Identifiers and Codec: Define the Data Identifiers (DIDs) and corresponding codecs in the library's configuration. This enables correct encoding and decoding of data between the test cases and the ECU.
- Session Management: Some UDS services may require the ECU to be in a specific diagnostic session (e.g., extended diagnostics). The library should be configured to manage these session transitions seamlessly.

2.4 Supported UDS Services

The **RobotFramework-UDS** library supports almost UDS service as defined in [ISO 14229](#), providing comprehensive coverage for ECU diagnostics.

For detailed information on specific services and how to use them, please refer to the next section.

2.5 Enhancements Usability with ODXTools Integration

The **RobotFramework-UDS** library comes with [odxtools](#) fully integrated, allowing you to use readable service names instead of dealing with hex IDs.

You can now specify service names directly in your test cases, making them more readable and user-friendly.

2.6 Examples

```

*** Settings ***
Library      RobotFramework_TestsuitesManagement    WITH NAME    testsuites
Library      RobotFramework_UDS
Suite Setup  Connect
Suite Teardown  Disconnect

*** Variables ***
${SUT_IP_ADDRESS}=    ecu_ip_address
${SUT_LOGICAL_ADDRESS}=    ecu_logical_address
${TB_IP_ADDRESS}=    client_ip_address
${TB_LOGICAL_ADDRESS}=    client_logical_address
${ACTIVATION_TYPE}=    0

${FILE}=    path/file.pdx
${VARIANT}=    variant

${NAME}=    UDS Connector

*** Keywords ***
Connect
    Log    Create a uds Connector
    ${uds}=    Create UDS Connector    ecu_ip_address= ${SUT_IP_ADDRESS}
    ...    ecu_logical_address= ${SUT_LOGICAL_ADDRESS}
    ...    client_ip_address= ${TB_IP_ADDRESS}
    ...    client_logical_address= ${TB_LOGICAL_ADDRESS}
    ...    activation_type= ${ACTIVATION_TYPE}
    Log    Using UDS Connector
    Connect UDS Connector    name=${Name}
    Log    Open uds connection
    Open UDS Connection
    Using pdx

Disconnect
    Log    Close uds connection
    Close UDS Connection

Using pdx
    Load PDX    ${FILE}    ${VARIANT}

*** Test Cases ***
Test user can use Tester Present service on ECU
    Log    Use Tester Present service
    ${response}=    Tester Present

Test user can use ECU Reset service on ECU
    Log    Use ECU Reset service

    Log    Hard reset
    ${response_hr}=    ECU Reset    1

    Log    Key off on reset
    ${response_k}=    ECU Reset    2

    Log    Soft reset
    ${response_sr}=    ECU Reset    3

    Log    Enable rapid power shut down
    ${response_e}=    ECU Reset    4

    Log    disable rapid power shut down
    ${response_d}=    ECU Reset    5

Test user can use Read Data By Name service on ECU
    Log    Use Read Data By Name service

    Log    readCPUClockFrequencies_Read

```

```
    ${service_name_list}=      Create List      readCPUClockFrequencies_Read
    Read Data By Name          ${service_name_list}

Test user can use Routine Control By Name service on ECU
    Log      Routine Control By Name service

    Log      PingTest_Start_NoResponse
    Routine Control By Name      PingTest_Start_NoResponse

Test user can use Diagnostic Session Control service on ECU
    Log      Diagnostic Session Control service

    Diagnostic Session Control      1
```

Chapter 3

DiagnosticServices.py

3.1 Class: DiagnosticServices

Imported by:

```
from RobotFrameworkUDS.DiagnosticServices import DiagnosticServices
```

3.1.1 Method: get_data_by_name

3.1.2 Method: get_encoded_request_message

Chapter 4

UDSConnector.py

4.1 Class: UDSConnector

Imported by:

```
from RobotFramework.UDS.UDSConnector import UDSConnector
```

4.1.1 Method: get_connection

4.2 Class: UDSConnectorManagement

Imported by:

```
from RobotFramework.UDS.UDSConnector import UDSConnectorManagement
```

4.2.1 Method: get_supported_type

4.2.2 Method: create_connector

4.3 Class: DoIPConnector

Imported by:

```
from RobotFramework.UDS.UDSConnector import DoIPConnector
```

4.3.1 Method: get_connection

Chapter 5

UDSKeywords.py

5.1 Class: UDSKeywords

Imported by:

```
from RobotFrameworkUDS.UDSKeywords import UDSKeywords
```

5.1.1 Method: connect_uds_connector

5.1.2 Method: create_uds_connector

Description: Create a connection to establish

Parameters:

- param name: Name of connection
 - doip: Establish a doip connection to an (ECU)
- type name: str
- **param ecu_ip_address (required):** The IP address of the ECU to establish a connection. This should be an address like "192.168.1.1" or an IPv6 address like "2001:db8::".
- type ecu_ip_address: str
- param ecu_logical_address (required): The logical address of the ECU.
- type ecu_logical_address: any
- param tcp_port (optional): The TCP port used for unsecured data communication (default is **TCP_DATA_UNSECURED**).
- type tcp_port: int
- param udp_port (optional): The UDP port used for ECU discovery (default is **UDP_DISCOVERY**).
- type udp_port: int
- param activation_type (optional): The type of activation, which can be the default value (ActivationTypeDefault) or a specific value based on application-specific settings.
- type activation_type: RoutingActivationRequest.ActivationType,
- param protocol_version (optional): The version of the protocol used for the connection (default is 0x02).
- type protocol_version: int
- **param client_logical_address (optional):** The logical address that this DoIP client will use to identify itself. This should be 0x0E00 to 0x0FFF. Can typically be left as default.
- type client_logical_address: int
- **param client_ip_address (optional):** If specified, attempts to bind to this IP as the source for both outgoing and incoming connections. Useful if you have multiple network adapters. Can be an IPv4 or IPv6 address just like ecu_ip_address, though the type should match.

- type `client_ip_address`: str
- **param `use_secure` (optional):** Enables TLS. If set to `True`, a default SSL context is used. For more details, see the `ssl` module. SSL context can be passed directly. Untested. Should be combined with changing `tcp_port` to 3496.
- type `use_secure`: Union[bool,ssl.SSLContext]
- **param `auto_reconnect_tcp` (optional):** Attempt to automatically reconnect TCP sockets that were closed by peer
- type `auto_reconnect_tcp`: bool

5.1.3 Method: `load_pdx`

Description: Load PDX

Parameters:

- **param `pdx_file`:** pdx file path
- type `pdx_file`: str
- **param `variant`:**
- type `variant`: str

5.1.4 Method: `build_payload`

5.1.5 Method: `validate_content_response`

Validates the content of a UDS response.

param `response` The UDS response object to validate.

param `expected_service` The expected service ID of the response.

param `expected_data` The expected data (optional) to be matched within the response.

return True if the response is valid, False otherwise.

5.1.6 Method: `create_config`

Description: Create a config for UDS connector

Parameters: Will be update later

5.1.7 Method: `set_config`

Description: Set UDS config Using `create_configure` to create a new config for UDS connector. If not, the default config will be use.

5.1.8 Method: `connect`

Description: Open uds connection

5.1.9 Method: `disconnect`

Description: Close uds connection

5.1.10 Method: `access_timing_parameter`

Description: Sends a generic request for AccessTimingParameter service

Parameters:

- param `access_type` (required): The service subfunction
 - `readExtendedTimingParameterSet` = 1
 - `setTimingParametersToDefaultValues` = 2
 - `readCurrentlyActiveTimingParameters` = 3
 - `setTimingParametersToGivenValues` = 4
- type `access_type` int
- param `timing_param_record` (optional): The parameters data. Specific to each ECU.
- type `timing_param_record` bytes

5.1.11 Method: `clear_dianostic_infomation`

Description: Requests the server to clear its active Diagnostic Trouble Codes.

Parameters:

- param `group`: The group of DTCs to clear. It may refer to Powertrain DTCs, Chassis DTCs, etc. Values are defined by the ECU manufacturer except for two specific values
 - `0x000000` : Emissions-related systems
 - `0xFFFFFFFF` : All DTCs
- type `group`: int
- **param `memory_selection`: MemorySelection byte (0-0xFF). This value is user defined and introduced**
Only added to the request payload when different from None. Default : None
- type `memory_selection`: int

5.1.12 Method: `communication_control`

Description: Switches the transmission or reception of certain messages on/off with CommunicationControl service.

Parameter:

- param `control_type` (required): The action to request such as enabling or disabling some messages. This value can also be ECU manufacturer-specific
 - `enableRxAndTx` = 0
 - `enableRxAndDisableTx` = 1
 - `disableRxAndEnableTx` = 2
 - `disableRxAndTx` = 3
 - `enableRxAndDisableTxWithEnhancedAddressInformation` = 4
 - `enableRxAndTxWithEnhancedAddressInformation` = 5
- type `control_type`: int
- param `communication_type` (required): Indicates what section of the network and the type of message that should be affected by the command. Refer to `CommunicationType<CommunicationType>` for more details. If an integer or a bytes is given, the value will be decoded to create the required `CommunicationType<CommunicationType>` object
- type `communication_type`: `CommunicationType<CommunicationType>`, bytes, int

* param `node_id` (optional): DTC memory identifier (`nodeIdentificationNumber`). This value is user defined and introduced in 2013 version of ISO-14229-1. Possible only when control type is `enableRxAndDisableTxWithEnhancedAddressInformation` or `enableRxAndTxWithEnhancedAddressInformation`. Only added to the request payload when different from None. Default : None * type `node_id`: int

5.1.13 Method: control_dtc_setting

Description: Controls some settings related to the Diagnostic Trouble Codes by sending a ControlDTCSetting service request. It can enable/disable some DTCs or perform some ECU specific configuration.

Parameters:

- **param setting_type (required):** Allowed values are from 0 to 0x7F.
 - on = 1
 - off = 2
 - vehicleManufacturerSpecific = (0x40, 0x5F) # To be able to print textual name for logging only.
 - systemSupplierSpecific = (0x60, 0x7E) # To be able to print textual name for logging only.
- type setting_type: int
- param data (optional): Optional additional data sent with the request called DTCSettingControlOption-Record
- type data: bytes

5.1.14 Method: diagnostic_session_control

Description: Requests the server to change the diagnostic session with a DiagnosticSessionControl service request.

Parameters:

- **param newsession (required):** The session to try to switch.
 - defaultSession = 1
 - programmingSession = 2
 - extendedDiagnosticSession = 3
 - safetySystemDiagnosticSession = 4
- type newsession: int

5.1.15 Method: dynamically_define_did

Description: Defines a dynamically defined DID.

Parameters:

- param did: The data identifier to define.
- type did: int
- **param did_definition: The definition of the DID. Can be defined by source DID or memory address**
If a MemoryLocation<MemoryLocation> object is given, definition will automatically be by memory address
- type did_definition: DynamicDidDefinition<DynamicDidDefinition> or MemoryLocation<MemoryLocation>

5.1.16 Method: ecu_reset

Requests the server to execute a reset sequence through the ECUReset service.

- **param reset_type (required):** The type of reset to perform.
 - hardReset = 1
 - keyOffOnReset = 2
 - softReset = 3
 - enableRapidPowerShutDown = 4
 - disableRapidPowerShutDown = 5
- type reset_type: int

5.1.17 Method: io_control

Description: Substitutes the value of an input signal or overrides the state of an output by sending a InputOutputControlByIdentifier service request.

Parameters:

- param did (required): Data identifier to represent the IO
- type “did”: int
- **param control_param (optional):**
 - returnControlToECU = 0
 - resetToDefault = 1
 - freezeCurrentState = 2
 - shortTermAdjustment = 3
- type control_param: int
- **param values (optional): Optional values to send to the server. This parameter will be given to Dictionary**
 - A list for positional arguments
 - A dict for named arguments
 - An instance of IOValues<IOValues> for mixed arguments
- type values: list, dict, IOValues<IOValues>
- **param masks: Optional mask record for composite values. The mask definition must be included in Dictionary**
 - A list naming the bit mask to set
 - A dict with the mask name as a key and a boolean setting or clearing the mask as the value
 - An instance of IOMask<IOMask>
 - A boolean value to set all masks to the same value.
- type masks: list, dict, IOMask<IOMask>, bool

5.1.18 Method: link_control

Description: Controls the communication baudrate by sending a LinkControl service request.

Parameters:

- **param control_type (required): Allowed values are from 0 to 0xFF.**
 - verifyBaudrateTransitionWithFixedBaudrate = 1
 - verifyBaudrateTransitionWithSpecificBaudrate = 2
 - transitionBaudrate = 3
- type control_type: int
- param baudrate (required): Required baudrate value when control_type is either verifyBaudrateTransitionWithFixedBaudrate (1) or verifyBaudrateTransitionWithSpecificBaudrate (2)
- type baudrate: Baudrate <Baudrate>

5.1.19 Method: read_data_by_identifier

Description: Requests a value associated with a data identifier (DID) through the ReadDataByIdentifier<ReadDataByIdentifier> service.

Parameters:

See an `example<reading_a_did>` about how to read a DID

- param data_id_list: The list of DID to be read

* type data_id_list: int | list[int] robotframework-uds-udskeywords-udskeywords-read-dtc-information -----

Update later robotframework-uds-udskeywords-udskeywords-read-memory-by-address -----

Description: Reads a block of memory from the server by sending a ReadMemoryByAddress service request.

Parameters:

- param `memory_location` (required): The address and the size of the memory block to read.

* type `memory_location`: `MemoryLocation` <`MemoryLocation`> robotframework-uds-udskeywords-udskeywords-request-download -----

Description: Informs the server that the client wants to initiate a download from the client to the server by sending a RequestDownload service request.

Effective configuration `exception_on.<type>.response server_address.format server_memorysize.format`

Parameters:

- param `memory_location` (required): The address and size of the memory block to be written.
- type `memory_location`: `MemoryLocation` <`MemoryLocation`>
- **param `dfi` (optional): Optional defining the compression and encryption scheme of the data.**
If not specified, the default value of 00 will be used, specifying no encryption and no compression
- type `dfi`: `DataFormatIdentifier` <`DataFormatIdentifier`>

5.1.20 Method: `request_transfer_exit`

Description: Informs the server that the client wants to stop the data transfer by sending a RequestTransferExit service request.

Effective configuration `exception_on.<type>.response`

Parameters:

- param `data` (optional): Optional additional data to send to the server
- type `data`: bytes

5.1.21 Method: `request_upload`

Description: Informs the server that the client wants to initiate an upload from the server to the client by sending a RequestUpload<RequestUpload> service request.

Effective configuration `exception_on.<type>.response server_address.format server_memorysize.format`

Parameters:

- param `memory_location` (required): The address and size of the memory block to be written.
- type `memory_location`: `MemoryLocation` <`MemoryLocation`>
- * **param `dfi` (optional): Optional defining the compression and encryption scheme of the data.**
If not specified, the default value of 00 will be used, specifying no encryption and no compression
- *type `dfi`: `DataFormatIdentifier` <`DataFormatIdentifier`>

5.1.22 Method: `routine_control`

Description: Sends a generic request for the RoutineControl service

Parameters:

- param `routine_id` (required): The 16-bit numerical ID of the routine
- type `routine_id` int
- param `control_type` (required): The service subfunction

- type `control_type` int
- **valid `control_type`**
 - `startRoutine` = 1
 - `stopRoutine` = 2
 - `requestRoutineResults` = 3
- param `data` (optional): Optional additional data to give to the server
- type `data` bytes

5.1.23 Method: `security_access`

Description: Successively calls `request_seed` and `send_key` to unlock a security level with the `SecurityAccess` service. The key computation is done by calling `config['security_algo']`

Effective configuration `exception_on.<type>.response security_algo security_algo_params`

Parameters:

- param `level` (required): The level to unlock. Can be the odd or even variant of it.
- type `level`: int
- param `seed_params` (optional): Optional data to attach to the `RequestSeed` request (`securityAccess-DataRecord`).
- type `seed_params`: bytes

5.1.24 Method: `tester_present`

Description: Sends a `TesterPresent` request to keep the session active.

Effective configuration `exception_on.<type>.response`

5.1.25 Method: `transfer_data`

Description: Transfer a block of data to/from the client to/from the server by sending a `TransferData` service request and returning the server response.

Effective configuration `exception_on.<type>.response`

Parameters:

- **param `sequence_number` (required):** Corresponds to an 8bit counter that should increment for each
Allowed values are from 0 to 0xFF
- type `sequence_number`: int
- param `data` (optional): Optional additional data to send to the server
- type `data`: bytes

5.1.26 Method: `write_data_by_identifier`

Description: Requests to write a value associated with a data identifier (DID) through the `WriteDataByIdentifier` service.

Effective configuration `exception_on.<type>.response data_identifiers`

Parameters:

- param `did`: The DID to write its value
- type `did`: int
- param `value`: Value given to the `DidCodec.encode` method. The payload returned by the codec will be sent to the server.
- type `value`: int

5.1.27 Method: write_memory_by_address

Description: Writes a block of memory in the server by sending a WriteMemoryByAddress service request.

Effective configuration `exception_on.<type>.response server.address.format server.memorysize.format`

Parameters:

- param `memory_location` (required): The address and the size of the memory block to read.
- type `memory_location`: `MemoryLocation <MemoryLocation>`
- param `data` (required): The data to write into memory.
- type `data`: `bytes`

5.1.28 Method: request_file_transfer

Parameters:

- param **moop** (required): Mode operate
 - `AddFile = 1`
 - `DeleteFile = 2`
 - `ReplaceFile = 3`
 - `ReadFile = 4`
 - `ReadDir = 5`
 - `ResumeFile = 6`
- type `moop`: `int`
- param `path` (required):
- type `path`: `str`
- param **dfi**: **DataFormatIdentifier** defining the compression and encryption scheme of the data.
 - If not specified, the default value of 00 will be used, specifying no encryption and no compression.
 - Use for moop: - `AddFile = 1` - `ReplaceFile = 3` - `ReadFile = 4` - `ResumeFile = 6`
- type `dfi`: `DataFormatIdentifier`

* param `filesize` (optional): The filesize of the file to write. If `filesize` is an object of type `Filesize<Filesize>`, the uncompressed size and compressed size will be encoded on the minimum amount of bytes necessary, unless a width is explicitly defined. If no compressed size is given or `filesize` is an `int`, then the compressed size will be set equal to the uncompressed size or the integer value given as specified by ISO-14229 Use for moop: - `AddFile = 1` - `ReplaceFile = 3` - `ResumeFile = 6`

- type `filesize`: `int | Filesize`

5.1.29 Method: authentication

Description: Sends an Authentication request introduced in 2020 version of ISO-14229-1. You can also use the helper functions to send each authentication task (sub function).

Effective configuration `exception_on.<type>.response`

Parameters:

- param **authentication_task** (required): The `authenticationTask` (subfunction) to use.
 - `deAuthenticate = 0`
 - `verifyCertificateUnidirectional = 1`
 - `verifyCertificateBidirectional = 2`
 - `proofOfOwnership = 3`
 - `transmitCertificate = 4`
 - `requestChallengeForAuthentication = 5`
 - `verifyProofOfOwnershipUnidirectional = 6`
 - `verifyProofOfOwnershipBidirectional = 7`
 - `authenticationConfiguration = 8`

- type authentication_task: int
- **param communication_configuration (optional):** Optional Configuration information about how to communicate. Allowed values are from 0 to 255.
- type communication_configuration: int
- **param certificate_client (optional):** Optional The Certificate to verify.
- type certificate_client: bytes
- **param challenge_client (optional):** Optional The challenge contains vehicle manufacturer specific formatted client data (likely containing randomized information) or is a random number.
- type challenge_client: bytes
- **param algorithm_indicator (optional):** Optional Indicates the algorithm used in the generating and verifying process which further determines the parameters used in the algorithm and possibly the session key creation mode. This field is a 16 byte value containing the BER encoded OID value of the algorithm used. The value is left aligned and right padded with zero up to 16 bytes.
- type algorithm_indicator: bytes
- **param certificate_evaluation_id:** Optional unique ID to identify the evaluation type of the transaction. The value of this parameter is vehicle manufacturer specific. Subsequent diagnostic requests with the same evaluationTypeId will overwrite the certificate data of the previous requests. Allowed values are from 0 to 0xFFFF.
- type certificate_evaluation_id: int
- **param certificate_data (optional):** Optional The Certificate to verify.
- type certificate_data: bytes
- **param proof_of_ownership_client (optional):** Optional Proof of Ownership of the previous given challenge to be verified by the server.
- type proof_of_ownership_client: bytes
- **param ephemeral_public_key_client (optional):** Optional Ephemeral public key generated by the client for Diffie-Hellman key agreement.
- type ephemeral_public_key_client: bytes
- **param additional_parameter (optional):** Optional additional parameter is provided to the server if the server indicates as neededAdditionalParameter.
- type additional_parameter: bytes

5.1.30 Method: routine_control_by_name

Description: Sends a request for the RoutineControl service by routine name

Parameters:

- **param routine_name (required):** Name of routine
- type routine_name: str
- **param control_type (required):** The service subfunction
- type control_type: int
- **valid control_type**
 - startRoutine = 1
 - stopRoutine = 2
 - requestRoutineResults = 3
- **param data (optional):** Optional additional data to give to the server
- type data: bytes

5.1.31 Method: read_data_by_name

Description: Get diagnostic service list by list of service name

Parameters:

- **param service_name_list:** list of service name
- type service_name_list: list[str]
- **param parameters:** parameter list
- type parameters: list[]

5.1.32 Method: `get_encoded_request_message`

Description: Get diagnostic service encoded request list (hex value)

Parameters:

- param `diag_service_list`: Diagnostic service list
- type `diag_service_list`: []
- param `parameters`: parameter list
- type `parameters`: list[]

Chapter 6

__init__.py

6.1 Class: RobotFramework_UDS

Imported by:

```
from RobotFramework_UDS.__init__ import RobotFramework_UDS
```

RobotFramework_UDS is a Robot Framework library aimed to provide UDP client to handle request/response.

Chapter 7

Appendix

About this package:

Table 7.1: Package setup

Setup parameter	Value
Name	RobotFramework.UDS
Version	0.1.0
Date	23.08.2024
Description	TODO
Package URL	robotframework-uds
Author	TODO
Email	TODO
Language	Programming Language :: Python :: 3
License	License :: OSI Approved :: Apache Software License
OS	Operating System :: OS Independent
Python required	>=3.0
Development status	Development Status :: 4 - Beta
Intended audience	Intended Audience :: Developers
Topic	Topic :: Software Development

Chapter 8

History

0.1.0	09/2024
Initial version	